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R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

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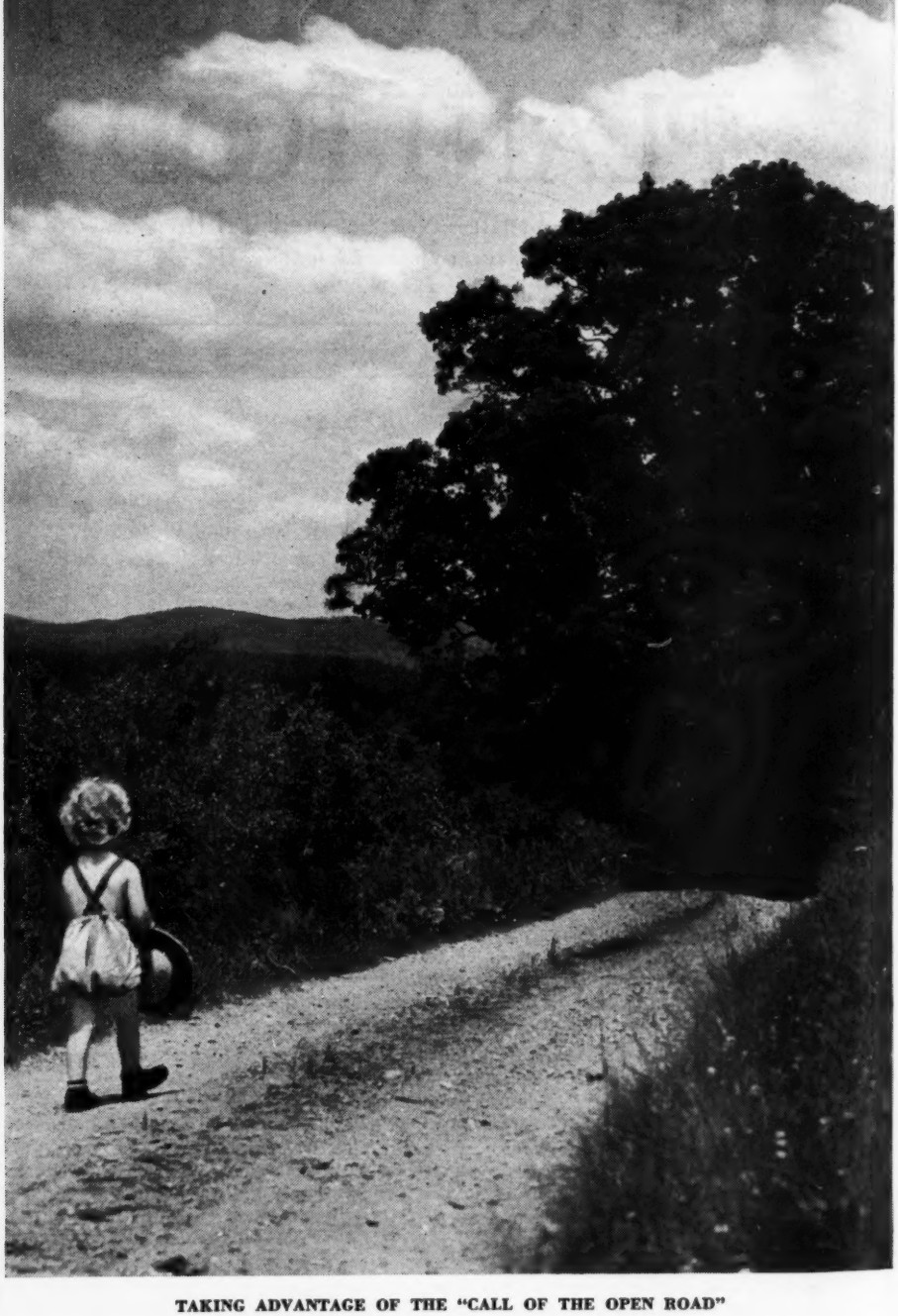

TAKING ADVANTAGE OF THE "CALL OF THE OPEN ROAD"

Better Crops with PLANT FOOD

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VOL. XXXII WASHINGTON, D. C., MAY 1948 No. 5

Work is necessary when . . .

Weed Time Cometh

Jeff McDermid

WELCOME rains of summer fall alike upon the just and the unjust, both upon the wheat for our needs and those bothersome weeds. Luckily, thanks to science, certain synthetic compounds, like 2,4-D and patent products similar thereto, arm the farmer with better ammunition to conquer vegetative cussedness than he possessed in my callow youth.

Were there no weeds and no unfavorable weather, the life of the farmer would be so monotonous that agriculture would lose its zest and its thrilling gamble. Instead of a modern farmer producing enough food to serve 13 other persons besides himself, the rate of increased output might soar to perplexing altitudes and make more congressional hearings necessary.

Here and there some ambitious agriculturist tackles the problem of misplaced plant life with temporary vengeance. He uses plenty of cuss-words, inflammable weapons, and smelly nostrums, or tar paper on small patches. He seldom stops to ponder that Agropyron repens and Cuscuta arvensis did not earn those names for nothing. He winds up, however, with more respect for the so-called "dead" languages when he sees how very much alive the nasty plants with Latin cognomens can be.

Probably the main difference between widow's weeds and ordinary farm weeds is that, if she wants to, the widow can get rid of hers faster than the farmer can. Both species are mournful enough, and both command a modicum of healthy respect.

I generally return to old Adam and Eve for a fresh viewpoint. It seems that he and his wife faced a dilemma. They found a big snake in Paradise and a riot of weeds when they got the gate. Then when Adam began his hopeless scrap with quackgrass and bindweed he made himself some applejack for personal solace. Then lo and behold, he saw that snake again! Yet if I were choosing between snakes and weeds, I, too, would quit the Promised Land. The trouble is that some of us have inherited both, along with boils and amortized mortgages. You can doctor the boils, scotch the snakes, and haggle off part of the mortgage, but the weeds persist forever.

I AM also convinced that weeds and not blisters were the cause of Job's lamentations; that weeds drove the Hebrews through the Red Sea toward Manhattan Island; and that they even helped to inspire the ancient patriots to fervent oratory. I am also convinced that weeds discouraged the American Red Man from becoming a real dirt farmer. Tracing their influence to modern times, I am sure that weeds robbed many of our farmers of the bathtubs and other gadgets they sorely wanted.

Besides, if it wasn't for weeds many an Extension worker would have to consult the research department for more new material. But while weeds have the right of way, the Extension folks always have plenty of new skills to discuss in their demonstrations.

In my own research I have found an underlying principle about weeds—they always come from the adjoining farm. They are like measles and the itch—somebody always gets them before we do and is more responsible than we are for spreading them. Few will stand up straight and admit personal responsibility for weed invasions.

We blame the wind, the cows, stray birds, peddlers, or our neighbor's laziness, but we never admit that we tested our seeds too little and too late. Human nature loves to assume virtues and deny discrepancies.

It is apparent that countless tons of packaged plant food are unintentionally used by farmers and gardeners to bolster the annual weed crop and make it thrive and tower above the tomatoes and the corn. Weeds are hungry feeders and lick their chops in glee over tasty balanced meals fed to them by generous grangers.

You won't need a Geiger counter or a handy set of isotopes to detect the net effect of commercial fertilizer and rotted manure on the pushing ranks of our noxious and less criminal weeds.

One drawback to proper weed control, it is said, is the unworkability of township inspection and penalty. That is somewhat delicate ground, because the philosophy of the bucolic mind believes firmly in freedom to weed 'em as he sees fit, or not at all. Any local government poking its long nose into private business is decidedly unwelcome.

TOO often the weed commissioners are our own neighbors, who dislike being drastic and caustic to us about toadflax and corn cockle. Thus the local weed eradication campaign drags behind.

One or two keen-minded county agents contrived to get around this barrier by suggesting that all weed inspectors be citizens of another community. They would travel across town lines to prod the livers out of the reluctant. Later the plan received some gilt-edged incentive through benefit payments to farmers who followed ideal systems of weed-killing. However, we still have weeds so tall that a farm reporter must use a tripod on his camera to take pictures across their waving tops. A few wiseacres have advised sowing hemp so that the weeds can simply hang themselves.

In all my rambles I seldom spent more congenial and cozy time than listening to a weed lecture in wintertime. There are wall charts that make everything easy and convincing. One for-

gets that the long underground rootstocks and the horny little seeds out there in the bare ground are able to withstand more zero weather than Admiral Byrd and Empire penguins. I have heard more arguments against weeds applauded and accepted in January and forgotten in June than there are sow thistles in Minnesota.

We sure take after Old Adam all the time. We are eager to clap and holler and adopt resolutions in the easy chair, but a mite slower in putting them into action at sweating time. Yet I would raise no barriers against all these worthy weed-talkers nor try to deter

them from churching us regularly. We and the weeds both need it.

Their first premise is that knowing the weeds one from 'tother is the way to begin. We cannot possibly exterminate anything permanently until we determine who and what it is, and then classify its feeding habits and range of adaptability. Hence few untaught scribes are better versed in the nomenclature of weedology than I am, having sat patiently through many lectures and scanned many nature leaflets. Still it is a rude shock when I find a farmer friend who doesn't know Amaranthus retroflexus from Plantago lanceolata, and yet harvests 45 bushels of plump wheat to the acre without taking dockage.

Then again it is good sport when all else fails to hang it on the seedsman. Often these gentry deserve it when they peddle screenings under bargain quotations, making unwary customers jump to the bait and imagine they have a sinecure when they sow three acres of alfalfa seed purchased for eight dollars and a half.

But out in my own state only about 15 per cent of all the field seeds put into spring cropland comes from reliable commercial sources. The bulk of it is bought or traded with neighbors. A good neighbor will either donate the best he has or give one a real bargain, on the basis of which public spirit it is unwise to ask too many questions. It's foolish to seek the real worth of a gift horse by peering in his face that way. Wait awhile and see how swift he kicks.

Fanning mills are probably no more popular as muscle developers than grindstones, which is one reason for so many bright yellow grain fields ablaze with mustard color. Farmers prefer working out in the fresh air with a cultivator to sticking at a stuffy and dusty job indoors with sieves and shakers.

One of the finest arrays of flora in a natural rock garden I ever beheld was at a place where a farmer upset his grain wagon near some boulders. The painstaking art of man in floriculture thus becomes a feeble gesture beside the natural vigor of untamed plant life. Whenever animate life of any kind is chased by foes and harassed by enemies there seems to arise some latent protective power, a will to live and multiply. Our weed neighbors gain power through being pariahs.

ONCE upon a time the Bishop of Newcastle was reported as saying, "Agriculture is a controversy with weeds." Agricultural science has taken pains to scour the earth and breed up new and better specimens of grain and corn. Nobody has ever done much on the other hand to pedigree the weeds or hybridize them or give them a hand in their struggle. Yet somehow they work out their own improvements and their own vigor unaided by man. This is like the ragged old buffalo and the

(*Turn to page* 50)

Fertilizer Consumption and Supply In the North Central States

By A. L. Mehring [1]

Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland

FERTILIZER consumption has increased in recent years in all parts of the United States, but much more rapidly in the North Central and Western States than in other sections of the country. The increased usage of plant food in the North Central Region was so outstanding that a study was made to determine the reasons for it, the prospects for continued growth, and the adequacy of production and distribution facilities to supply expected future demand.

Personal visits were made and correspondence carried on with a number of key people in the fertilizer industry and the agricultural colleges of nearly all of the North Central States in order to further the study. The field trip occupied about one month in the fall of 1947. The persons consulted may be classified as follows:

Class	*Number*
Fertilizer manufacturers	15
Plant managers	6
Sales managers	4
Coop executives	6
Retail fertilizer dealers	2
Industry representatives	33
State soil scientists and agronomists	13
Hybrid Corn Seed Co., soil fertility expert	1
Fertilizer control official	1
County agricultural agent	1
Scientists	16
Total	49

[1] Credit is due Walter Scholl and Hilda M. Wallace for assistance in the statistical work.

Plant-food Consumption

Each region of continental United States has used more plant food each season than in the previous one in every year since 1933, except 1938 and 1947. Several of the Eastern and Southern States used less in 1947 than in 1946, but consumption of plant food continued to increase in the North Central and Western Regions. The percentage increases of consumption in 1947 over the 5-year prewar average (1935-1939) are as follows:

Region	*Per cent increase*
New England	66
Middle Atlantic	72
South Atlantic	57
East North Central[1]	254
West North Central[2]	586
South Central	140
Western	387

[1] Michigan, Ohio, Indiana, Illinois, Wisconsin.
[2] Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

In those sections where fertilizer has been used by almost all farmers (the first three regions above), consumption increased 57 to 72 per cent. In the other regions where many farmers still do not use fertilizers, consumption has increased relatively much more.

The greatest increases occurred in Illinois, Wisconsin, Minnesota, Iowa, and Kansas, as may be seen in Table I. Farmers in these 5 states in 1947 used 6 to 18 times as much fertilizer as they did in 1930, whereas consumption in the remainder of the country increased

75 per cent. During the depression years of the 30's, consumption in the states mentioned above dropped much lower and, with the exception of Kansas, the curtailment of consumption lasted longer than in the rest of the country. The fertilizer used in Wisconsin, Illinois, Minnesota, Iowa, the Dakotas, Nebraska, and Kansas in those depression years was applied mostly to gardens, truck, and specialty crops. In 1933 the combined tonnage of these 8 states was about one-third of what it had been in 1930, while that of the country as a whole was about two-thirds. In 1930 these 8 states accounted for 2.2 per cent of the U. S. total consumption of plant food, in 1933 for only 1.2 per cent, but in 1946 for 8.1 per cent. In other words, when farm income dropped fertilizer usage in this region fell faster than in any other part of the country. During the past 5 years on the contrary it has grown more rapidly in this section. Thus in the past, fertilizer usage has fluctuated much more widely in the North Central States, except Ohio, Indiana, and Michigan, than in the Coastal States.

The North Central Region as a whole used 11.6 per cent of the total U. S. consumption of plant food in 1930, 10.3 per cent in 1933, 22.0 per cent in 1946, and 25.3 per cent in 1947.

TABLE I.—TOTAL PLANT-FOOD CONSUMPTION

State and Region	1930	1932	1933	1935	1937	1939	1941	1943	1945	1946	1947[3]
	1,000 tons of N available P_2O_5[1] and K_2O										
Ohio	62.4	32.2	41.1	62.1	76.6	74.3	90.7	116.0	144.9	164.5	173
Michigan	29.7	17.2	17.4	24.0	32.2	33.0	45.5	56.2	80.0	90.5	93
Indiana	50.3	17.5	22.2	45.3	55.0	47.5	66.7	93.0	121.7	144.4	149
Illinois	8.9	3.7	3.7	5.4	8.4	10.7	18.7	33.6	65.3	84.7	98
Wisconsin	12.8	5.9	3.7	6.9	10.4	10.8	25.7	43.6	66.6	79.4	87
E. No. Central	164.1	76.5	88.1	143.7	182.6	176.3	247.3	342.4	478.6	563.5	600
Minnesota	4.3	2.6	2.0	3.1	3.6	3.8	9.3	13.7	30.3	41.0	43
Iowa	5.2	2.3	1.0	1.2	2.2	3.0	6.1	13.6	37.7	48.8	52
Missouri	9.6	3.7	4.7	11.7	16.0	13.7	17.8	30.3	37.3	54.2	57
Kansas	1.0	.26	.38	1.6	4.2	3.6	5.5	7.2	10.6	13.7	18
Neb., N. D. & S. D.	1.2	.21	.27	.41	.8	1.3	1.7	1.9	3.4	7.9	10
W. No. Central	21.3	9.07	8.35	18.01	26.8	25.4	40.4	66.7	119.4	165.5	180
Rest of U. S.	1,337.8	732.5	829.5	1,054.0	1,411.0	1,396.0	1,635.1	1,979.8	2,265.0	2,355.0	2,300
	Per cent of 1930[2]										
Ohio	100	52	66	100	123	119	145	186	232	264	277
Michigan	100	58	59	81	108	111	153	189	269	304	313
Indiana	100	35	44	90	109	94	133	185	242	287	296
Illinois	100	41	41	61	94	120	208	375	730	947	1,101
Wisconsn	100	46	29	54	82	84	201	342	522	622	680
E.No.Central	100	47	54	88	111	107	151	209	292	343	366
Minnesota	100	60	45	72	83	86	214	315	697	942	1,000
Iowa	100	44	19	23	42	57	116	260	720	931	1,000
Missouri	100	39	50	122	167	143	186	317	390	567	594
Kansas	100	26	38	160	415	361	546	724	1,059	1,361	1,800
N. D., S. D. & Neb.	100	17	22	34	67	111	144	159	278	649	833
W. No. Central	100	43	39	85	126	119	190	313	559	774	845
Rest of U. S.	100	55	62	79	105	104	122	148	169	176	172

[1] Includes 3 per cent of P_2O_5 in the phosphate rock used for direct application.
[2] Calculated from original data rather than the abbreviated figures above. See Table IX in the Appendix for greater details for certain years.
[3] Preliminary estimate.

A breakdown of the total plant food consumed in each North Central State into nitrogen, available P_2O_5, total P_2O_5, and K_2O for 1936, 1940, 1944, 1945, and 1946 is given in Table IX in the Appendix. It should be noted that in all these states the proportion of P_2O_5 to the other nutrients is higher than in other parts of the country. The available plant-food ratio in this region when nitrogen is taken as 1 is 1-6.3-2.9 in 1937, and 1-5.8-3.0 in 1947. The corresponding ratios for the country as a whole are 1-1.9-1 and 1-2.1-1.1.

A rapid growth is especially noteworthy in Illinois in the total P_2O_5 figures. In most states the difference between the total P_2O_5 and available P_2O_5 is relatively small and can be accounted for almost entirely by the insoluble P_2O_5 of superphosphate. In Illinois it is due principally to ground phosphate rock. Although Ohio, Michigan, and Indiana each use more available P_2O_5 than Illinois, the latter state in 1946 used 193,000 tons, or twice as much total P_2O_5 as any other state in the North Central Region, and considerably more than any other state in the United States. The nearest approach was 140,000 tons in North Carolina.

Government Programs

Table II shows the tonnages of plant food that farmers obtained in connection with Government sponsored programs from 1940 to 1946, inclusive. These were the Soil Conservation Program and the Tennessee Valley Authority Fertilizer Demonstrations. Phosphates comprised the bulk of the materials provided, although substantial amounts of potash materials were included in certain years.

The Agricultural Conservation Program of the U. S. Department of Agriculture assisted farmers in obtaining fertilizers for use in growing soil-conserving crops in three ways. These were (1) by direct distribution, (2) by issuing purchase orders, good for purchase of fertilizers in regular trade channels, and (3) by reimbursement for fertilizers bought with the farmer's own funds. In 1942 and 1943 the Government paid on the average approximately 95 per cent and the farmer 5 per cent of the cost of fertilizers used in approved practices under the Soil Conservation Program. In later years the farmer's share of the cost has been increasing until in 1947 it was, on the average, about 35 per cent. His share of the cost in a given state is the same, no matter which of the 3 plans mentioned above is operating.

Very little plant food was accounted for by Government action in the North Central Region prior to 1940. Even in

TABLE II.—AVAILABLE[1] PLANT FOOD FOR WHICH ASSISTANCE WAS PROVIDED[2] IN CONNECTION WITH THE AGRICULTURAL CONSERVATION AND TENNESSEE VALLEY DEMONSTRATION PROGRAMS IN THE NORTH CENTRAL STATES AND PER CENT[3] THAT THIS REPRESENTS OF THE TOTAL CONSUMPTION, BY YEARS.[4]

	1940		1941		1942		1943		1944		1945		1946	
	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent	1,000 tons	Per cent
E. No. Central..	5.5	2.5	15.3	6.2	43.1	12.9	106.9	30.1	96.3	22.8	146.3	32.4	168.8	31.8
W. No. Central.	2.5	7.6	7.9	19.5	13.3	24.0	33.8	50.5	40.1	40.6	44.0	40.9	59.0	40.6
Rest of U. S....	161.1	9.1	180.6	9.4	186.4	9.0	282.0	11.8	258.7	9.6	346.9	12.1	359.4	11.6

[1] For total P_2O_5 see Table IX in the Appendix.
[2] Starting in 1942 the farmer has borne part of the cost. See text under "Government Programs."
[3] Calculated from the original data rather than from the abbreviated figures.
[4] Program years. For the Tennessee Valley Authority this means years ending June 30. For the Department of Agriculture the years ended on various dates until 1943 when all states in this region ended their years on December 31. Since then they are on a calendar year basis. The 1943 Agricultural Conservation Program year was 15 months long for the North Central States. The total consumption data used to compute the percentages are given for a part of the years in Table IX.

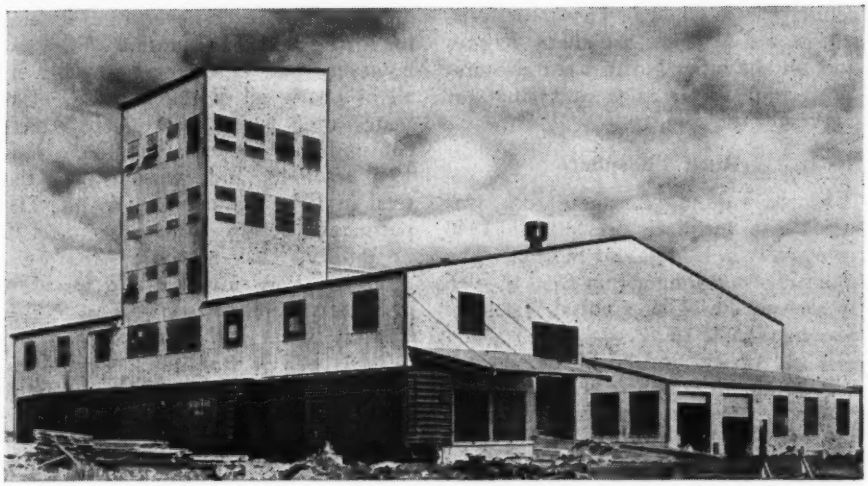


Fig. 1. A new fertilizer plant built at Green Bay, Wisconsin, by a farmer-owned cooperative.

that year it was comparatively small. The Agricultural Conservation Program expanded rapidly, however, from 1940 to 1943 and became important in all of the Midwestern States except the Dakotas and Nebraska.

The total consumptions of all fertilizers in the North Central Region in 1945 and 1946 were 2,837,495 and 3,440,010 tons, respectively. In the same years the Agricultural Conservation Programs for these states included 1,045,093 and 1,291,584 tons, or 36.8 and 26.6 per cent, respectively. The Tennessee Valley Program in the North Central Region consumed 2,860 and 2,651 tons of fertilizers in these 2 years. The T. V. A. programs therefore involved only a few hundred tons of plant food in each of the Midwestern States. None was supplied by T. V. A. in the Dakotas and Nebraska.

During the past 4 years Government programs have accounted for about one-tenth of the total plant-food consumption in the United States, but in most of the North Central States this part has been from one-quarter to one-half of the total.

Consumption of fertilizers that were used without the assistance of the Government programs in the North Central Region did not grow as rapidly as the total consumption shown in Table I. Table III makes the comparison.

TABLE III.—INCREASES IN CONSUMPTION OF PLANT FOOD BY FARMERS WITHOUT GOVERNMENT ASSISTANCE AND TOTAL INCREASE, 1930-1946.

State	Without assistance	Tota
	Per cent	*Per cent*
Ohio	98	164
Michigan	83	204
Indiana	123	187
Illinois	575	847
Wisconsin	243	522
E. No. Central	141	243
Minnesota	537	842
Iowa	460	831
Missouri	217	467
Kansas	1,100	1,261
N. D., S. D. & Neb.	533	549
W. No. Central	400	674
Rest of Country	49	76

The increases for Ohio, Michigan, and Indiana without Government assistance are about double that of the

country as a whole. Those for Wisconsin and Missouri are about 5 times and for the other North Central States 10 or more times as great as that for the rest of the country.

Rock Phosphate

Finely ground phosphate rock was used as a fertilizer previous to 1940 principally in Illinois and Florida. The quantities consumed from 1940 to 1946 in each of the North Central States are given in Table IV.

The Agricultural Adjustment Administration bought and supplied ground phosphate rock for the first time in the 1941 program. In 1941 and 1942 this material was thus used only in Illinois. The cost of its use for given soil conservation purposes, however, was partly reimbursable in all or nearly all of the North Central States even before 1941. The total consumption increased tenfold from 1940 to 1946, and two-thirds of the total in 1946 was provided by the Department of Agriculture either directly or indirectly. The conservation program in 1946 involved 357,348 tons of rock phosphate in the East North Central States and 8,384 tons in the West North Central States. Before the program began Illinois had been applying about 50,000 tons and Indiana about 5,000 tons annually. All the rest of the Midwest together used 2 or 3 thou-

TABLE IV.—CONSUMPTION OF PHOSPHATE ROCK IN THE NORTH CENTRAL STATES AND PER CENT OF THE TOTAL CONSUMPTION USED IN AGRICULTURAL CONSERVATION PROGRAMS, BY YEARS.[1]

State & Region	1940	1941	1942	1943[2]	1944	1945	1946
				Tons			
Ohio	80	235	70	180	941	779	1,986
Michigan	.....	.....	.....	97	555	633	1,273
Indiana	3,948	5,887	6,468	6,081	13,068	20,505	25,751
Illinois	47,823	68,290	128,904	175,581	218,992	381,751	498,162
Wisconsin	586	869	767	1,352	2,499	2,846	2,620
E. No. Central	52,437	75,281	136,209	183,291	236,064	406,514	529,792
Minnesota	.....	125	210	40	730	1,573	1,865
Iowa	1,194	530	314	1,972	6,025	6,783	10,327
Missouri	273	922	542	916	1,412	2,136	4,908
Kansas	722	440	60	200	250	240	960
N.D., S. D., & Neb.	.....	.....	.....	40	148	57	120
W. No. Central	2,189	2,017	1,126	3,168	8,565	10,789	18,180
Total	54,626	77,298	137,335	186,459	244,629	417,303	547,972
				Per cent of total used in Agricultural Conservation Program[2]			
E. No. Central	0	7.91	10.32	77.16	75.62	68.02	67.45
W. No. Central	0	0	0	49.62	53.96	60.99	46.11
Total	0	7.70	10.23	76.69	74.86	67.84	66.74

[1] The tonnages shown in the Table are for calendar years. Data for the Conservation program used in calculating the percentages were for program years.

[2] The data for periods prior to 1943 for the Conservation Programs are for years ending September 31. The 1943 data are for 15 months ending December 31. Since then the programs coincide with the calendar year.

sand tons. In 1946 Midwestern farmers bought about 181,000 tons in addition to that secured in connection with the program. The usage for other purposes, therefore, increased about threefold.

Rates of Application

The increase in consumption of plant food in the Midwest is due both to larger applications per acre by farmers who have long used fertilizer and to new usage by consumers who never used it before. Even now, however, only a relatively small percentage of the farmers in the western part of the North Central Region use fertilizers. This is clear from the rates of plant-food consumption per acre shown in Table V.

TABLE V.—AVERAGE RATE OF PLANT-FOOD CONSUMPTION, 1946 FISCAL YEAR

Region or State	Pounds per harvested acre	
	Available plant food	Insol. P_2O_5 in rock phosphate
South Atlantic	82	[1]
New England	76	[1]
Middle Atlantic	46	[1]
North Central	7	2.1
Ohio	29	.11
Indiana	25	1.3
Michigan	21	.09
Wisconsin	14	.14
Illinois	7.7	14.5
Missouri	7.7	.23
Minnesota	4.2	.06
Iowa	3.9	.27
Kansas	1.0	.03
Nebraska	0.25	.000
North Dakota	0.21	.000
South Dakota	0.06	.004

[1] Not available but known to be relatively small.

In comparing these rates of plant-food consumption the following facts should be kept in mind. The North Central Region not only has naturally productive soils, but also grows relatively larger acreages of those legumes that are highly efficient nitrogen-fixers than other sections of the country and is primarily a livestock region, where considerable portions of the nutrients removed by cropping from soils are returned in manures. Midwestern crops, therefore, have available larger quantities of plant nutrients from non-fertilizer sources than those grown on most soils in other regions. In the western part of the North Central Region soils are not subject to severe leaching, which makes maintenance of the productivity of soils in regions of heavy rainfall so difficult.

Shortages

Serious shortages of plant food occurred in the West North Central States as compared with the demand during the past year. Nitrogen and potash were short of meeting the demand for separate applications during the spring of 1947 and probably will be again in the spring of 1948. The principal shortage during the fall of 1947 was potash. As a result many companies allocated all or most of their supplies of nitrogenous and potassic materials to the manufacture of mixed fertilizers. Farmers in many cases were required to accept mixed fertilizers containing a higher proportion of P_2O_5 than was wanted or to do without. For example, many farmers asking for 4-12-8, which is recommended for certain crops in these states, were unable to get it and had to take 2-12-6. For certain conditions in this region agronomists recommend the use of muriate of potash alone or 0-9-27 fertilizer. The closest substitute that many planters could buy was 0-12-12.

In the western part of this region even superphosphate was locally short of meeting the demand at times during the past year. The large expansion in usage of rock phosphate both for soil conservation and other purposes was partly due to shortages of superphosphates. Recently 18 to 20 per cent superphosphate has been shipped into this region from points more than a

thousand miles away. The average shipment from the plant to the farmer in this part of the country is over 100 miles. These long hauls make double superphosphate more economical in this area. Many fertilizer manufacturers in this region would use more double superphosphate (40 to 50 per cent grades) if they could get it.

Minnesota, Wisconsin, and Missouri would have consumed something like 30 per cent more fertilizer in 1947, according to the best informed opinion in the region, if all kinds and grades had been freely available. The demand in Kansas and Iowa appears to have exceeded the supply by as much as 75 per cent.

Although no serious shortages were reported in Ohio, Indiana, and Michigan during the past year, many farmers could not buy exactly what they wanted or what the local agricultural scientists were advocating. The fact that many farmers have not been able to buy nitrogen and potash materials separately even in this section, where shortages were less acute, is indicated not only by the farmers' complaints but also by the statistics. For example, the percentage of the total consumption of nitrogen used as a separate application in Ohio declined from 25 in 1939 to 11 in 1947. Similar figures for potash are 2.3 and 0.3. Both manufacturers and agronomists told the writer that the only reason 2-12-6 continues to be sold in the North Central Region in considerable tonnages is because of insufficient supplies of N and K_2O to make the grades now recommended by agronomists.

The situation is now improving because of new plants that are coming into production in this region. Increasing quantities of fertilizers are also moving into this part of the country from eastern and southern plants. In October 1947 every plant visited appeared to be well stocked with super-

Fig. 2. Control panel of an automatic fertilizer mixing unit now in use in several Midwestern plants. The formula for a mixture of six or less materials is set up on the dials and buttons are punched for the number of tons desired. The machine then automatically starts mixing and continues until the number of tons set up has been delivered or a storage bin runs out of material. In either case, the machine stops, a bell rings, and if the stoppage is due to an empty bin, a warning light indicates which bin.

phosphate and some grades of mixed fertilizers. The impression was gained that much larger stock piles are now on hand in fertilizer plants than a year ago.

Reasons for Increased Consumption

The reasons for the rapid expansion of fertilizer usage in the past decade are discussed in publications by Truog [2] and by Monthey.[3] Many additional reasons were given by the key people interviewed in this study.

The various reasons may be summarized in the order of their importance in bringing about the changes in consumption, according to the viewpoint of the majority, under the following headings: (1) farm income; (2) education and demonstration; (3) changes in crops; (4) soil depletion; and (5) miscellaneous.

Practically everybody consulted gave high farm income or crop prices as the most important reason for the phenomenal rise in demand in the past 5 years. In recent years most Midwestern farmers have had more ready money than they ever had before in their lives. Although more fertilizer was obtainable, many other things, such as certain kinds of farm machinery, automobiles, radios, etc., which the farmer and his family wanted, were more difficult to obtain. Furthermore, during every season since 1939 the farmer has been reasonably sure of a good market for all the crop he could produce and the price of fertilizers has increased very little in comparison. Under such circumstances fertilizer consumption was bound to increase. Did it increase in proportion to the greatly enlarged income from crops in recent years?

In Table VI are shown the expenditures for fertilizers in relation to income from crops and government payments in 3 Midwestern States for the past 22 years. These 3 states are the only ones in the region for which the needed basic data are readily available. The results for years from 1925 to 1943 are computed from data given by Mehring.[4] Those for subsequent years were calculated in the same way from new data. In making these calculations, deductions were made for the fertilizers used in Government programs. Expenditures for fertilizers were also compared with total cash farm income, but the correlation through the years 1925 to 1946 is not quite as good as with income from crops and government payments only.

TABLE VI.—FERTILIZER EXPENDITURES IN CENTS PER DOLLAR OF PREVIOUS YEAR'S CASH FARM INCOME FROM CROPS AND GOVERNMENT PAYMENTS IN 3 NORTH CENTRAL STATES.

	Ohio	Indiana	Minnesota
	Cents	*Cents*	*Cents*
1925	8.8	7.6	[1]
1926	8.3	7.8	[1]
1927	7.6	7.7	[1]
1928	8.7	8.4	.65
1929	11.3	12.9	.61
1930	10.5	11.6	.76
1931	8.5	8.7	.97
1932	5.4	6.1	.81
1933	8.3	8.2	.79
1934	9.5	9.9	.66
1935	8.7	8.0	.60
1936	9.1	9.6	.44
1937	8.6	9.1	.55
1938	8.0	8.1	.46
1939	10.6	9.4	.58
1940	8.8	8.1	.63
1941	10.6	9.3	.58
1942	10.5	9.5	.71
1943	8.6	7.3	.84
1944	9.5	7.9	.71
1945	9.1	8.5	1.04
1946	8.7	9.0	1.66
1925–39 Av.	8.80	8.88	.66
1940–46 Av.	9.39	8.51	.88
Standard error of the mean	1.23	1.42	.26

[1] Data not available.

[2] Fertilizer usage in the Midwest. Emil Truog. Plant Food J. 1 (No. 2) 6-9 (1947).

[3] Thirty years of building up the soils in Wisconsin. L. G. Monthey. Better Crops with Plant Food. 31 (No. 1) 6-10, 44, 45 (1947).

[4] Fertilizer expenditures in relation to farm income. A. L. Mehring. Better Crops with Plant Food. 28 (No. 8) 10-16, 47-48 (1944).

Although total farmer expenditures for fertilizers in Ohio and Indiana have increased sevenfold in 1946 as compared with 1933, they have represented about the same proportion of cash farm income from crops plus government payments in both states in every year for which the data are available. The average is very close to 9 cents out of every dollar received. The figures for recent war years are not statistically different from the similar figures for prewar years. To be considered different statistically, they must differ by more than double the standard error, which in the case of Ohio is 1.2 cents and in that of Indiana 1.4 cents. Thus it appears that the farmers of Ohio and Indiana continue to spend the same proportion of their income for fertilizer that they did 20 years ago.

In the case of Minnesota, however, the facts are clear that farmers are now spending a larger part of their income for fertilizers than they did 20 years ago. In 1946 they spent more than twice as much in proportion. The farmers of Iowa, Missouri, Kansas, Wisconsin, and Illinois are also spending a larger fraction of their income for this purpose.

Commercial fertilizers regularly cost more delivered in the central states than they do in the coastal states. On the other hand, crops bring higher prices on eastern farms. For example, a ton of 2-12-6 fertilizer in 1945 cost about $30 and $38 in Georgia and Iowa, respectively, but the average prices paid farmers for corn in 1945 in Georgia and Iowa were $1.50 and $1.03 per bushel, respectively. Under present average Minnesota and Iowa conditions it takes 50 cents worth of commercial nitrogen to produce one bushel of increased corn yield, which can be sold for much more than the total cost of production. During the years from 1931 to 1940 the average amount of nitrogen required to increase yields by one bushel cost about 40 cents, but during this decade the average price paid for corn at the 5 largest Midwestern markets was 61.1 cents per bushel and the average price paid in Iowa was 53.0 cents. The average price in Iowa exceeded 50 cents in only 4 of these 10 years. The highest was $1.07 in 1936 and the lowest 28 cents in 1931. Therefore much of the extra corn that could have been produced in this area by applying commercial fertilizers would have been worth less or very little more than it cost to produce it. For the reasons stated above, the level of farm income has to be higher in the Midwest in order to make the use of fertilizer profitable for general field crops than it does in the coastal states. Farm income in the West North Central States has been above this level in recent years, but was below it much of the time prior to 1939.

Relatively large acreages of high value crops, such as tobacco, potatoes, truck, and citrus, are grown in the eastern as compared with the central states and a very large part of the total consumption of fertilizers is on such crops. These facts, of course, account for many of the differences in average consumption rates on all crops among various regions.

The consensus of opinions expressed to the writer is that the Agricultural Conservation Program has been first in effectiveness among the forces of education and demonstration in getting farmers to use fertilizer in the North Central Region.

Some of the industry representatives interviewed felt strongly that the college and extension people should have advocated the use of commercial fertilizers much more vigorously than they did before the war. Although the agronomy and soils departments of our midwestern colleges and experiment stations have been accumulating experimental evidence on responses to each of the major plant nutrients on crops grown on various soils for many years, many of the scientists west of the Mississippi River did not urge the general use of commercial fertilizers on

(*Turn to page* 40)

SCS Photo

Fig. 1. Cattle harvest grass from this native grass pasture without cost to the owner and produce beef, while the grass protects the soil. Red Plains Conservation Experiment Station, Guthrie, Oklahoma.

More Abundant Living With Soil Conservation

By Harley A. Daniel

Soil Conservation Service, Guthrie, Oklahoma

NATURE has endowed the great Southwest with millions of acres of fertile soil which gradually are being depleted of plant nutrients by wind and water erosion and the continual production of crops. The business of every farmer is to remove as large a crop as the soil is capable of producing, but failure will result eventually, regardless of the productivity of the land, unless provisions are made for controlling erosion and maintaining fertility.

Henry G. Bennett, President of Oklahoma A. and M. College, says that if Oklahoma continues to lose soil in the next 53 years as rapidly as during the past, agriculture will be confined to a few isolated, protected valleys. The policy of every landowner, therefore, should be to adopt a system of farming which will conserve the maximum amount of soil resources. At the same time, however, he must provide a living for himself and family.

In addition to the demands of our own people for food, we are now faced with the problem of supplying food to war-devastated countries in Europe and the Orient as a means of establishing peace and reducing starvation. When human food is produced, it takes plant food from the soil and increases ero-

sion which hastens permanent damage to the land. As the soil is depleted, there is an increased demand for more intensive use of the remaining land on which crop farming can be maintained. This means less good land for fewer people, and finally starvation.

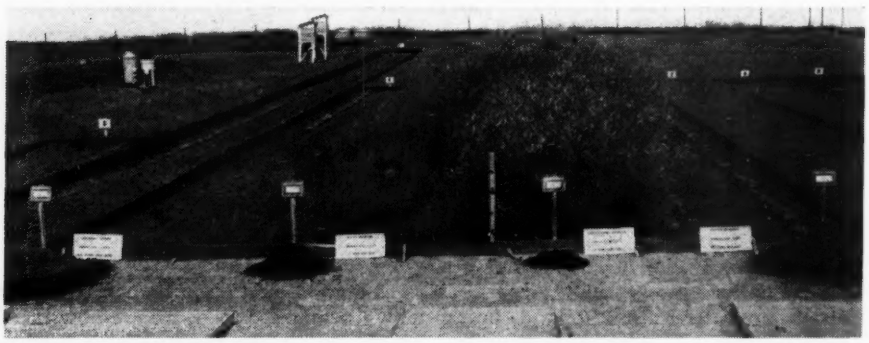
As Elmer T. Peterson of the Daily Oklahoman has pointed out, "Man's living is derived from the soil alone, and as long as people and soil survive, the real resources of civilization survive." H. H. Bennett, Chief of the U. S. Soil Conservation Service, and his associates have repeatedly stressed that our real wealth is in the precious topsoil, as virile people and fertile soil go together. You cannot have one without the other.

Nature once had all the land protected with grass and other thick-growing vegetation; but as man destroyed this cover, severe erosion started. The average soil loss from bare, hard, fallow land at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma, was 1,100 times more and the runoff water 31 times more than that from Bermuda grass. This is convincing evidence that soil erosion was not a major problem when this country was covered with grass and timber.

Sound Land Use

Although thick-growing plants control erosion and rebuild soils, all the land cannot be put to grass or other permanent vegetation. Certain annual food crops must be grown on cultivated land. These crops can be safely grown on the more level, deep, permeable soils if the soils are protected from erosion by adequate soil conservation measures. The shallow, sloping, highly erodible soils, as well as others unsuited for cultivation, are more stable and useful when put to permanent vegetation and used for livestock production. The basis, therefore, for getting more food is an understanding of land capability and nature's methods of protecting and developing soil, water, and vegetation.

The soil, slope of the land, crop adaptation, and management of each farm are different. That is why trained personnel should make a complete inventory of every acre of an individual farm and recommend the uses for which each type of land is best fitted. Such factual information provides the basis for the planning of a coordinated soil conservation program that includes: (1) Sound land use; (2) right combination of conservation practices;



SCS Photo

Fig. 2. Crop Rotations Conserve Soil. The piles of soil represent the average annual amount of erosion from the different crops in the rotation since 1930 at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma. Pile 1, on the left, was from continuous cotton, while Piles 2, 3, and 4 were from the respective crops of wheat, sweet clover, and cotton in the rotation. During the last three years of this period, the yield of the cotton in the rotation was 68 per cent greater than that from the continuous area.

SCS Photo

Fig. 3. Dairy cattle grazing on hairy vetch that is being used in a crop rotation for soil protection and improvement near Pryor, Oklahoma. It produces excellent pasture from about March 1 to May 15 in this area. At this time the cattle must be removed if a seed crop is produced. Vetch together with adequate mineral fertilization has increased the yield of cotton about 50 per cent on the Red Plains Conservation Experiment Station, Guthrie, Oklahoma.

(3) maintenance and improvement of soil productivity; and (4) economically sound farm management.

Sound land use and practical conservation farming make up the first line of defense against erosion and provide an opportunity for greater production. Livestock make grassland useful and restore to the soil the life-giving elements needed by growing plants. Soil conservation and balanced farming are being accompanied logically and profitably by sound development of the livestock industry.

Controlling Erosion

The most effective method of controlling erosion is with grass and other thick-growing vegetation. During the last 16 years, the average annual water loss from grassland was 97 per cent less than that from an adjacent bare, hard, fallow area on the Station at Guthrie. A simple crop rotation on cultivated land has reduced the runoff water 33 per cent and soil loss 76 per cent annually. At the Wheatland Conservation Experiment Station, Cherokee, Oklahoma, terraces and contour cultivation reduced the annual water losses through runoff 42 per cent the last five years on deep, fertile soil. This water was stored in the soil for plant use and did not contribute to the flood waters of the local streams. The water that did leave these fields moved slowly and carried only small quantities of soil. Water allowed to flow swiftly, however, carries large amounts of soil.

Most of the land suitable for cultivation is subject to either wind or water erosion. The most desirable erosion control practice for deep lands in the humid area is a well-planned system of terraces designed to reduce the amount and velocity of runoff from fields, supplemented by crop rotations. It is also advisable for all cultivation to be conducted on the contour and the cropping system to include as many close-growing, sod-like crops of legumes and better grasses as possible. In addition to the conservation of crop residues and the use of manure, lime and fertilizer are recommended when needed. Due to the importance of

moisture for crop production in the arid section, terraces may be designed to conserve moisture, and cultivation and cropping systems be such as to uniformly distribute and economically use the rainfall to produce crops and maintain a protective cover.

Pasture, hay, or woodland are the only crops which will keep some land producing profitably. Experiments conducted on the Station at Guthrie show that millions of acres of eroded and unused land, once considered practically useless, can be developed to produce much of the nation's badly needed beef and dairy products. At the same time, this land will be protected and improved.

If the land to be revegetated is seriously gullied or sheet-eroded, special treatment will be necessary to re-establish vegetation. In some areas it may be necessary to divert the runoff water from the original channels by installing contour furrows or ridges between and above the source of the gullies. Satisfactory vegetation can then be obtained by installing barriers of brush and crop residue, plowing down gully banks, applying a light application of fertilizer and lime when needed, and introducing legumes. After the legumes are established, grasses may be introduced by applying seed in mulches or seed-hay. Harry M. Elwell of the Soil Conservation Service, Guthrie, Oklahoma, says that where such procedure has been followed, the density of the vegetation in the treated gullies was over three times greater than that of the untreated.

Making Good Pasture

Soil conservation investigations are clarifying the relationship of soil, plants, and animals. Proper combinations of commercial fertilizer, legumes, and grasses will do wonders for inherently poor soils. Through this type of erosion control and pasture improvement, together with proper management, much of the shallow, eroded, and unused land can be converted into useful pasture and meadows and satisfactory returns obtained.

Cattlemen depend largely upon adequate and economical feed production. An important part of the needed feed

SCS Photo

Fig. 4. This Bermuda grass pasture near Mt. Pleasant, Texas, was improved by fertilization and seeded to lespedeza and annual spring clovers. Pastures like this increase milk production, stabilize farm income, and save the soil.

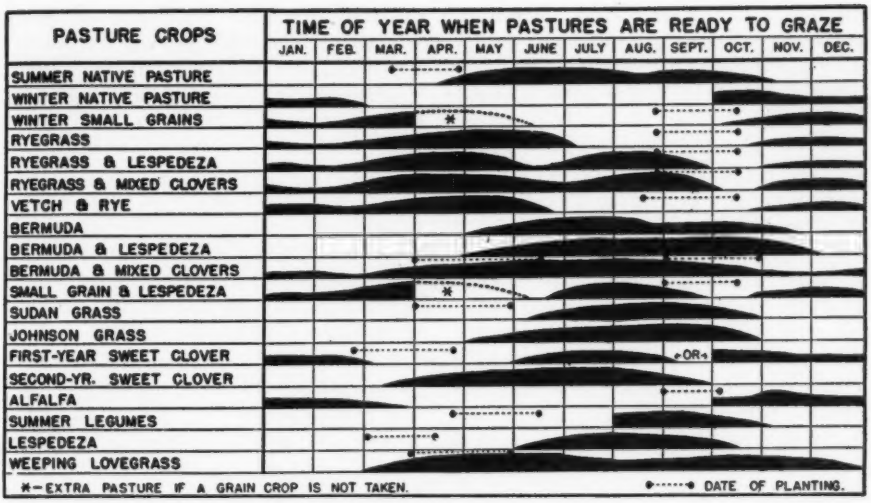


Fig. 5. This pasture calendar was prepared by Oklahoma A & M College and shows some of the crops which can be used to get good pastures in Central Oklahoma a large part of the year. Similar calendars can be worked out for each farm throughout the country. The width of each line indicates the amount of grazing available from the crop listed at the left.

can come from wise planning and extensive use of pastures and roughages. Green pasture in prime condition of growth on fertile soil is a highly concentrated feed. A pasture which provides livestock with a maximum amount of nutritious green forage will do much toward producing more food and conserving soil.

Two trends of thought are evident in efforts to furnish year-round green forage, says B. W. Allred of the Soil Conservation Service at Fort Worth, Texas. One is to develop combinations of pastures for use at different seasons. The other is to provide different mixtures in one pasture. Whichever way it is done, Allred states, good green pasture produces milk and beef two to four times more economically than dry roughage and concentrated feed in a stall. Furthermore, livestock harvest the pasture feeds without cost to the owner.

Permanent pastures come first in any plan for providing as many days of good grazing as possible. But for a year-round combination of green forage, temporary or supplemental pastures will be an essential part of the program, according to Hi W. Staten of Oklahoma A. and M. College. A good starting point, Staten says, is to list all the pasture crops adapted to the local soils and climatic conditions. From this list a succession of crops can be worked out so that one will come into good grazing condition just as another passes its prime.

Range forage and pasture grasses vary during the season and from year to year in their feeding value and are often deficient in protein, calcium, and phosphorus. Green, immature grasses are a much better source of minerals and protein than hay or mature plants from the same land. They are usually about four to five times as rich in minerals as mature grass. But legumes in general contain more nutrients than grasses. In a typical study they contained on the average 3.9 times more calcium, 1.7 times more phosphorus, and 2.6 times more nitrogen than grass. To help overcome deficiencies in pasture herbage, legumes should be grown where possible. The legumes also produce nitrogen for the soil, which stimulates the growth of grass.

A combination of pastures involves

the use of all the farm land. Legumes and better grasses are naturally a part of a good cropping system for cultivated land. Such crops may be used for pasture, but the fields they occupy must be planned so livestock can be rotated from one to another. The crops also must be arranged in sequence so there will be as few gaps as possible in the grazing schedule.

Small grain provides good winter grazing, as does rye grass. Good winter pasture combinations include various kinds of clovers and vetch with small grain or rye grass. Clovers and other legumes are ideal to supplement grass and to provide a longer grazing season. Sudan grass makes excellent temporary pasture in late spring and summer months.

Mixtures of grass and legumes when properly fertilized yield up to three times as much green feed of better quality than those not fertilized. In general, lime, mineral fertilizers, and nitrogen will increase both the yield and quality of forage on land which needs them. The full value of fertilizer is not obtained, however, unless it is applied in combination with the best possible soil- and water-conserving practices. When fertilizing with mineral fertilizers it sometimes may be desirable to make an application sufficient to take care of the plant needs for several years instead of making light applications annually.

Wise Management of Pastures

Pastures are made to use, and maximum use should be the aim of every pasture system. Green and nutritious forage should be kept ahead of the livestock. A pasture schedule of this nature—involving adapted soils, crop rotation, native and/or tame grasses, legumes, and supplementary feed—requires careful planning and intelligent management.

Plenty of forage does not necessarily mean that livestock are well fed. Nutritious and bone-building forage cannot be grown on soils which are low in essential minerals. Fertilizers will provide these minerals, and a soil test showing which are needed should be made. Pasture weeds rob grasses and legumes of soil moisture, sunlight, and plant food. Weeds not eaten by livestock should be controlled by mowing at the proper time. Natural mulch should be allowed to accumulate to stimulate biological activity and control erosion. This necessitates fire prevention.

Pastures will not meet all the feed requirements through the entire year and especially during hazardous dry seasons. There will be gaps in the pasture schedule when it will be necessary to provide hay and grain for the purpose of keeping up the milk flow or putting on gains the year round. To insure plenty of grain, roughage, and protein for this purpose, careful planning of cultivated crops is important.

Proper grazing develops and maintains vigorous pasture plants. It causes them to make a better turf development and to root more deeply into the soil. Good grazing practices will help to keep the vegetation in excellent condition and aid in better utilization throughout the pasture. Adjustment of grazing periods to permit the grass to produce seed is helpful in improving and maintaining a cover. Systematic rotation of pastures also increases the yield and quality of feed.

Production Increased

When sound land-use practices are combined with wise management, production is increased. A simple crop rotation of cotton, wheat, and sweet clover in combination with adequate fertilization increased the yield of cotton 68 per cent during the last three years of a 17-year period at Guthrie, Oklahoma. Winter cover crops of vetch, together with phosphate fertilizer, have increased the average annual yield of cotton 47 per cent during the last 16 years. The yield of crops was also increased by contour cultivation and strip-cropping. Terraces increased

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Mr. McCue believes in keeping records on the fertility and physical condition of his soils.

Sweet Clover Helps J. Ed McCue

By Howard Lathrope

Purdue University, Lafayette, Indiana

DEEP in "Little Egypt" within sight of the foothills of the Ozarks in Gallatin county, Illinois, lives J. Ed McCue. His father and grandfather lived here before him. Six thousand acres of the best land in Gallatin and Saline counties are farmed by Mr. McCue and his 20 tenants. For nearly 50 years he has been husbandman for these 6,000 acres, carefully managing, protecting, and preserving the soil.

"I've tried to plow back enough profit and soil-building residues so that my children will find the soil better than I did 50 years ago," says this hardy pioneering Scotsman. Fifty years ago Mr. McCue tore down the fences and discontinued livestock farming. "Livestock keeps you working 365 days every year, but the crop system we have been following has saved us a right smart amount of aggravation and started us on the road to making money," he says.

"I started back in 1920 to find out something for myself and I tried a new rotation on a 100-acre field which had been yielding 15 bushels of wheat and 40 bushels of corn per acre. A rotation consisting of corn two years, sweet clover two years, and wheat two years has helped us to increase yields. This same field now yields 30 bushels of Fultz wheat and 80 bushels of corn and I don't have to stutter when I say these yields are secured every year."

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Will These New Tools Help Solve Some of Our Soil Problems?

By Benjamin Wolf

Seabrook Farms Company, Bridgeton, New Jersey

SOME new developments in agriculture offer hope of a solution to several of its most serious soil problems. These problems have been particularly troublesome in recent years and have been most acute wherever intensified agriculture has been practiced. I refer to the poor physical characteristics of many soils which can be related to their general depletion of organic matter. At present, the new developments are only a hope. Much work has to be done before these new tools can be utilized in a practical system. This article is being written at the present time in order to stimulate research in this direction.

Years ago, agriculture in many areas was not so intensified and each farmer had his livestock, with considerable land in hay and pasture and considerable manure to apply to his fields. The relatively high level of organic matter still remaining from original forest or prairie plus organic matter added by farming practices gave good tilth to the soil. Water infiltration and water-holding capacity were favorable. The surface crusting of soils was not nearly so serious, so that roots had ample air. With ample moisture and air and deeper soils, plants were much less subject to the vagaries of climate. Yield was primarily limited by nutrition (partly supplied by organic matter), disease and insects, and limits of a variety.

As agriculture shifted to a more intensive type of farming, many areas still maintained good organic matter and soil tilth by applications of large amounts of manure available from livery stables in the city. Today, in the motor age, the livery stable is gone. What manure is available is expensive and insufficient to cover the needed areas. The gradual elimination of horses from the farm also reduced the amount of manure available and reduced the acreage of hay and pastures (soil-protecting crops). The use of tractors and heavy machinery accentuated the physical difficulties due to lack of organic matter by further compacting the soil. It also stimulated the further expansion of acreage to crops which do not protect the soil.

What has happened? The original organic matter in such areas has dropped to very low levels. These levels are expressions of a new equilibrium as a result of small or no additions of organic matter, greater "burning" of organic matter with more soil plowing, disking, and cultivating, and heavy losses due to erosion.

As organic matter was lowered, several effects have gradually become apparent. A much poorer infiltration of water into soils has resulted. Heavy showers can compact the surface of even light soils. The tight surface and the compact soil lessen the rate of water infiltration. Water failing to enter the soil fast enough has gone over the surface, accelerating the rate of erosion

which in turn lowers still further the organic matter supplies. Lacking organic matter, many soils cannot hold much water and plants suffer drought quickly. Irrigation is resorted to but eventually soil structure is in poorer shape where irrigation is practiced. Surfaces sealed during a rain or irrigation prevent sufficient air from entering roots, and plants of poorer vigor are a result.

Many people have come to the conclusion that physical structure of the soil is our No. 1 problem. This is especially true since today we can do a very good job of providing sufficient nutrients for crops. Careful soil analysis and interpretation of results can help provide nutrients in abundance for a bumper crop. These nutrients are not fully utilized until at the same time the soil is in such physical condition that optimum use of air and water can also be made.

What is the answer? Recognizing the problem, we at the G.L.F.-Seabrook Farms Raw Products Research Division have spent considerable time in trying to find an answer or answers to this difficulty.

Reverting to a More General Type of Agriculture

The growing of a sod crop at least once in three years would seem to offer some hope. If the sod crop is a hay for which there is a market, some of the benefits of a sod can be obtained while still getting returns for acreage. Though this treatment may be effective, most of the patients do not care to take the cure and most of them will not until it is absolutely necessary to do so. Farmers of intensive systems have considerable investment in acreage, irrigation, machinery, etc. They would like to use such investment as fully as possible in production of their specialized crop or crops. While they may be willing to reduce the number of crops planted in a field any one year, the resting of a field for an entire year seems to be difficult to take.

Organic Matter Additions

The Research Division has investigated the use of many materials that could be added to the soil; i.e., peat, sewage sludge, chicken manure, mushroom manure, and wood waste products. Generally, these products in the amounts needed to do the job are too expensive except for specialized crops of high monetary value. Possible exception is chicken manure which can help reduce cost of fertilization. Even with this product, because of its relatively low nutrient content, its use is relegated to areas close to source.

In mentioning these products, it might be well to point out that use of calcium lignin sulfonate, a waste product from the paper pulp industry, was most effective in improving tilth and water infiltration capacity in soils. Used in applications of as little as 2½ tons per acre, it gave a marked effect. If ever this material should be significantly reduced in price from its present high of $35 per ton, it would have a very important place in intensified agriculture.

Growing Organic Matter in Place

The cheapest way to provide organic matter is to grow it in place in form of cover or green manure crops. However, the amounts supplied are generally small. The amounts of non-leguminous crops can be markedly increased by use of mixed fertilizers. This treatment brings a double return since the nutrients are available for the succeeding cash crop.*

While a benefit, the use of cover crops even with fertilization does not seem to be the complete answer. At least something more is needed on such soils which have reached very low levels of organic matter.

Combinations

The use of fertilized cover crops, additions of materials such as chicken

* "Fertilizing vegetables by applying fertilizer to preceding cover crop," by Benjamin Wolf, Better Crops With Plant Food, No. 1, 1947.

manure, and reducing the number of cash crops grown in a field in any one year make it possible to do a better job on these fields low in organic matter. A new equilibrium is reached where soils contain slightly more organic matter than before and so have better physical properties.

Mulches

It is possible that the organic matter in these soils would be more effective if a large portion of it were present on the surface as a mulch. Great benefits in physical structure of a soil are attributed to soil mulches. A mulch breaks up the force of raindrops and lessens erosion by preventing compaction of the surface and movement of soil due to raindrop action and by improving water infiltration and water-holding capacity. Even during extended dry periods there is usually moisture under a mulch. The moisture is due to several factors; namely, lessened evaporation, better water infiltration at each rain, and condensation of moisture from the atmosphere due to lower temperatures maintained. Better moisture conditions and lower temperature prevent considerable fixation of nutrients, and plants thrive in the presence of ample supplies of nutrients, moisture, and air.

Although the virtues of a mulch have been known for some time, true mulches have been used only sparingly. Principle objections, at least for cultivated crops, have been high cost of providing a mulch and difficulty in preparing soil and cultivating where mulch was used.

In certain portions of this country stubble mulch farming has become popular either for non-cultivated crops or in areas where weeds are no serious problem or where soils have fairly good physical characteristics. Primarily due to the work of Professor Duley, new equipment has been designed to prepare soil, seed crops, and cultivate in the presence of stubble mulch. In general, a good job has been done in conserving moisture and lessening erosion in these areas.

In other areas where cultivated crops, large weed population, and compact soils are present, stubble mulch farming is much less popular. The practice of disking instead of plowing as suggested by Faulkner has not worked out too well in such areas. In a test with canning peas, disking instead of plowing has given us a 30 per cent decrease in yield. Reduction of yield was attributed to a much higher population of weeds and a more compact soil where disking was used. Disking opened the soil to a depth of about 4 to 5 inches, while plowing gave a seedbed 8 inches deep.

New Approaches to Mulching

Mulching could be practiced in many more areas if: (1) The mulch could be grown in place; (2) soil-bed prepared without disturbing mulch, (For most areas this means loosening the soil to a depth of 8 inches or more.); (3) seeding and another equipment devised for working in a mulch; and (4) weeds coming through the mulch could be controlled with little or no difficulty.

When these are broken down into individual components, it appears possible that a plan could be worked out whereby mulching would be practical. Use of two new tools, chemical weed control and deep tillage plows which do not turn a furrow, might make mulching a reality.

The system proposed would work something like this. A cover crop would be planted in the fall and it could be fertilized at that time to give a large growth. A type of cover crop such as oats which will winterkill could be used, or an overwintering cover crop could be killed in the spring with weed-killing chemicals. A vetch cover crop perhaps could be killed with 2,4-D, used in low concentrations and only enough to wet the plants in order to avoid any injury to the succeeding crop. Use of high aromatic oil fractions

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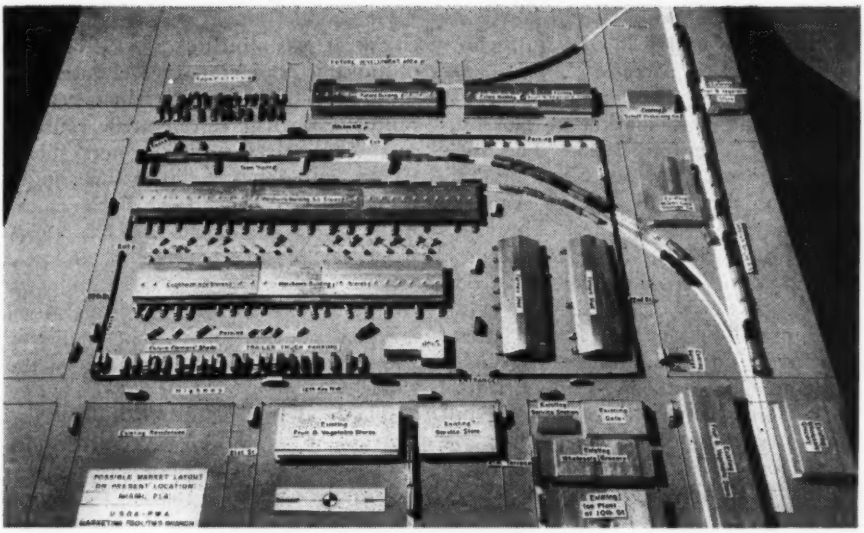


Proposed plan for rehabilitated market at Miami, Florida.

Better Markets for Better Crops

By C. B. Sherman

Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

BETTER markets for better crops might not be a bad slogan. For it is an astonishing fact that while a virtual revolution has been going on in farm techniques and practices, while new and unexcelled records have been rung up in yields and total production, and while the use of fresh fruits and vegetables in the diet of great and growing city populations has been soaring, the large city markets through which many of the crops must pass are almost as they were before all this expansion began. This is especially true of the large city markets for fruits and vegetables, which are often congested beyond description.

Of course the war stopped building and improvements for a considerable time. Some of the cities that had made serious studies of their market conditions and expected to improve them were stopped in their tracks. Anyway we can say the war stopped them. Some had acted in time and so were better off during the exigencies of the war.

Snapping into Action

Once again action is the key word. Cities are studying their conditions and getting plans ready so they can go forward as soon as materials and labor are at hand. Several have already forged ahead on the building, and at least one of these new markets is practically ready for opening.

The U. S. Department of Agriculture is helping in all the planning stages

and a good deal more. Right now it is working with nearly 30 cities in regard to their market places.

You can find this work in all its stages. The new market at Jackson, Mississippi, opens in 1948. The surveys are completed in New Haven, Columbus, Richmond, Atlanta, Tampa, St. Louis, Hartford, and Houston. Local groups are studying the reports or are making recommendations or decisions. It is expected that work on building will be started in most of these markets by July. Studies are well along in Benton Harbor, San Antonio, Little Rock, Columbia, and Baton Rouge, and other surveys are under way in about 18 other cities. Large and moderate-sized markets of all kinds are included. These surveys are usually made in cooperation with the marketing people in the state, so local conditions will be fully considered.

Thorough-going

The market facilities staff of the Federal Department has been rebuilt and revitalized since the war. There are marketing specialists for each group of farm commodities that passes through our markets, and there is an architectural engineer and an equipment specialist. Other men on the staff have special skills. It has more requests than it can handle. When it takes on a city it studies at first hand, on the site, each local set of conditions. It analyzes its findings, makes a detailed preliminary report including estimates of costs and savings, and offers a specific proposed plan with recommendations. With a model of the proposed new or rehabilitated market, the report and recommendations are taken back to the city. There everything is gone over and debated with the local officials and interested groups often including organizations of farmers and growers. A complete exchange of views is the goal. Practical suggestions that will help to reshape the plan may be made. As soon as possible a final report is made to the community.

One model layout serves for all the cities. It was built to scale. It consists of movable refrigerated warehouses, administration buildings, grain elevators, railroad tracks, refrigerated railroad cars, wholesalers' stores, farmers' sheds, trucks, and other facilities that might be necessary. By shifting the arrangement of this model or parts of it, a proposed layout for a market of any size on any proposed site can be reproduced. If several sites are under consideration, a visual comparison can be made by using the different arrangements of the model.

The model is just as useful when improvements of old markets are under study. And renovating an existing market may be just as useful as building a new one. In Miami, for stated reasons, no new market location was recommended. The present market area can be rehabilitated and expanded. It was recommended that the wholesale produce market be developed further and along specified lines, to serve the city better. The proposals were adopted, financing has been arranged, and early construction is expected.

Through to the Finish

The Department representatives follow through, for there may be many knotty phases to be worked out. They may help the local people draw up legislation that may be necessary in certain instances. They may arrange for financing, or work with the local architect who will supervise the construction. Or they may plan with power companies and other utilities for the incoming lines and services and with railroads regarding tracks and switching service.

New Equipment

Equipment that is suitable in progressive markets is also under study. This is a new line of work and includes such things as elevators, conveyor systems, the new pallets with fork-lifts, and the lighting arrangements, and

(*Turn to page* 48)

PICTORIAL

A May basket like one of these would prove acceptable to almost everyone.

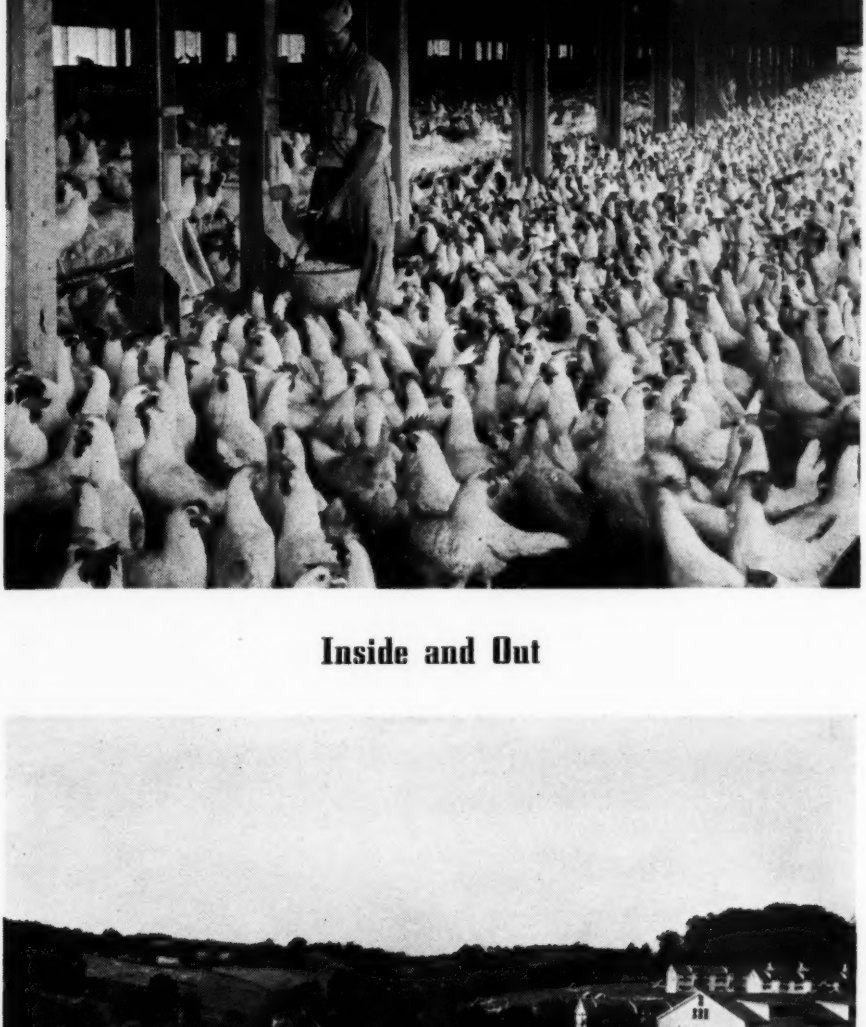
Courtesy WIZ Farm News Program

Above: **You can lead a horse to water, but you can't make him drink.**

Below: **The feed in this trough, practically speaking, is going directly to the ultimate consumer.**

Above: Sunshine, fresh water, and plenty of good pasture help grow Indiana's prime beef.

Below: Some very important and confidential last-minute instructions on proper show-ring behavior.



Inside and Out

The Editors Talk

Methods of Measuring Pasture Production

The greatly increased interest in pastures throughout almost all of North America during the last several years has resulted in an expanded volume of pasture investigations to determine which combinations of grasses, which management practices, and which fertilizer treatments will be the most efficient and economical. Investigators soon came up against the problem of how to measure pasture production.

At first glance this appeared to be a simple problem but as refinements in treatments were introduced, it soon became evident that the ordinary methods of measuring results frequently did not give the desired answers. Some investigators would let grass grow to a stage near maturity and measure the results in terms of hay yields or occasionally as green grass. This obviously did not simulate the animals' methods of harvesting a pasture but it was thought that probably the results were more or less comparable. Investigations of the composition of forage plants at different stages of growth disclosed wide variations in the relative content of nutrients between young and older plants, indicating that a plant at the hay stage certainly was not the type of forage the animal would normally consume on a pasture.

An approach to actual conditions was the adoption of frequent clipping of young grass during the growing season, the total production of the pasture being measured by the sum of the various clippings. Here again artificialities soon became apparent in that the botanical composition of the sward in the areas being clipped frequently was observed to be different from that in the areas being pastured normally.

A closer approach to actual conditions was achieved by the use of animals, changes of weight of the animals being used as the measure of pasture production. Difficulties here are introduced by the difference in the way animals are able to assimilate or utilize forage as well as the necessity of employing larger areas for the plots under study.

New Zealand Studies

An interesting comparison of methods for measuring the production of pastures has been made by P. B. Lynch, Field Crop Experimentalist of the New Zealand Department of Agriculture, and published in the New Zealand Journal of Science and Technology—Agricultural Section—for April 1947. The world-wide reputation of New Zealand as a pasture country makes all the more significant the investigations reported in this article.

The methods discussed in more or less detail by the author include: *Haying and grazing trials,* which are promptly dismissed owing to the shortcomings mentioned; *mowing trials* in which the clippings are discarded, with shortcomings as mentioned; *Hudson's alternate mowing and grazing technique* in which

duplicate areas are mowed and then later grazed so as to overcome to some extent the problem of abnormal botanical composition; *mowing and returning clippings technique* which appears to have some advantage if carefully conducted; *the Sears technique* whereby stock droppings are returned in proportion to treatment production, apparently satisfactory from some viewpoints but laborious, time-consuming, and expensive; *pure white clover sward technique,* in which the response of a pure stand of clover to the treatment is taken as indicative of a desirable treatment for the pasture, offering the advantage of small plots that are easily handled but introducing the problem of obtaining desirable stands and possible artificial methods of measuring results in that most pastures are a combination of clovers and grasses.

The author maintains that additional methods worthy of trial include: *Pot trials* which are highly artificial although very rapid and economical for preliminary work; *the use of tethered or enclosed animals for grazing* which requires very careful management and raises the question as to whether the animals graze naturally under such conditions; *alternate year trials* in which the plots are mowed one year and pastured the next; *pure grass swards,* subject to the same or even more criticism than the pure white clover swards; and *plucking or shearing* the areas instead of mowing.

Mr. Lynch then discusses a series of large-scale methods which employ the use of animals for measuring the results. In the *enclosure technique* movable enclosures varying in size from 5½ ft. square to 11 ft. square are placed in a normal pasture area and moved frequently so as to maintain normal botanical composition, the yields being measured by clippings. This has been one of the most satisfactory methods. The *difference technique* estimates the amount consumed by the animal by weighing cuttings made at various times in an area being pastured. The *constant animal weight technique* varies the number of animals that can be carried on an area so as to maintain the animals at a constant weight. For more general demonstration purposes, *animal production and growth trials* can be established.

The author has rendered a distinct service in bringing together in this manner the advantages and shortcomings of the various approaches to studying pastures. The number involved probably will be surprisingly large to most readers.

Many of these techniques are still in an experimental stage and the author feels that none of them necessarily presents the final answer as to the most desirable method of measuring pasture results. Possibly there never will be such a single method, the one to be employed being governed by circumstances. It is highly desirable, however, that constant search be made for improved techniques in pasture work because of the very difficulty of measuring the results and the great economical as well as sociological importance of pastures in our national welfare.

Cultivated Thought

"No other human occupation opens so wide a field for the profitable and agreeable combination of labor with cultivated thought as agriculture. Every blade of grass is a study; and to produce two where there was but one is both a profit and a pleasure. The thought recurs that education—cultivated thought—can best be combined with agricultural labor, or any labor, on the principle of thorough work, and ere long the most valuable of all arts will be the art of deriving a comfortable subsistence from the smallest area of soil." . . . Abraham Lincoln.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1923	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.5	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	21.2	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	28.3	38.2	124.0	219.0	136.0	185.0	17.30	71.40	....
1947									
April	32.26	30.1	147.0	233.0	163.0	240.0	17.20	88.00	....
May	33.50	44.6	153.0	233.0	159.0	239.0	16.80	83.70	....
June	34.07	46.0	156.0	249.0	185.0	218.0	16.00	79.60	....
July	35.88	48.5	169.0	251.0	201.0	214.0	15.10	79 00	....
August	33.15	38.1	161.0	270.0	219.0	210.0	15.30	75.50	....
September	31.21	40.7	149.0	240.0	240.0	243.0	16.10	75.60	....
October	30.65	41.6	150.0	205.0	223.0	266.0	16.80	90.60	....
November	31.87	40.0	166.0	195.0	219.0	274.0	17.30	89.10	....
December	34.06	46.9	172.0	204.0	237.0	279.0	18.10	94.80	....
1948									
January	33.14	45.9	186.0	217.0	246.0	281.0	18.70	95.10	....
February	30.71	38.5	193.0	231.0	192.0	212.0	19.60	88.60	....
March	31.77	29.6	196.0	237.0	211.0	221.0	19.70	87.90	....

Index Numbers (Aug. 1909—July 1914 = 100)

1923	231	190	133	137	129	105	110	183	....
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	171	366	205	232	198	170	127	227	224
1946	228	382	178	249	212	209	146	317	204
1947									
April	260	301	211	265	254	271	145	390	295
May	270	446	220	265	248	270	142	371	286
June	275	460	224	284	288	247	135	353	215
July	289	485	242	286	313	242	127	350	189
August	267	381	231	308	341	238	129	335	211
September	252	407	214	273	374	275	136	335	179
October	247	416	214	233	347	301	142	402	238
November	257	400	238	222	341	310	146	395	272
December	275	469	247	232	369	316	152	420	294
1948									
January	267	459	267	247	383	318	158	422	320
February	248	385	277	263	299	240	165	393	320
March	256	296	281	270	329	250	166	390	295

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947						
April	2.41	1.51	11.72	10.79	12.75	11.39
May	2.41	1.51	10.55	9.98	12.75	8.80
June	2.41	1.51	10.94	9.98	12.75	8.26
July	2.41	1.59	12.56	9.98	12.75	8.66
August	2.53	1.60	13.01	9.98	12.75	8.73
September	2.66	1.73	13.65	10.41	12.75	10.72
October	2.66	1.78	15.00	10.85	12.75	13.66
November	2.66	1.78	14.22	11.06	12.75	11.53
December	2.71	1.78	15.98	11.71	12.75	12.81
1948						
January	2.78	1.83	16.22	11.71	12.75	13.28
February	2.78	1.90	15.03	12.15	12.90	12.60
March	2.78	1.90	13.68	12.06	9.47	9.47
	Index Numbers (1910-14 = 100)					
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947						
April	90	53	335	306	378	324
May	90	53	301	283	378	250
June	90	53	313	283	378	234
July	90	56	359	283	378	246
August	94	56	372	283	378	248
September	99	61	390	295	378	305
October	99	62	429	307	378	388
November	99	62	406	313	378	328
December	101	62	457	332	378	364
1948						
January	104	64	463	332	378	377
February	104	67	429	344	383	358
March	104	67	391	342	281	269

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	. . .
1925	.600	2.44	6.16	.584	.860	23.72	....
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367[1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947							
April	.740	2.97	6.60	.535	.797	26.00	.200
May	.740	2.97	6.60	.535	.797	26.00	.200
June	.752	2.97	6.60	.330[1]	.589[1]	12.76[1]	.176
July	.760	2.97	6.60	.353	.629	13.63	.188
August	.760	3.08	6.60	.353	.629	13.63	.188
September	.760	3.42	6.60	.353	.629	13.63	.188
October	.760	3.42	6.60	.375	.669	14.50	.200
November	.760	3.42	6.60	.375	.669	14.50	.200
December	.760	3.42	6.60	.375	.669	14.50	.200
1948							
January	.760	3.42	6.60	.375	.669	14.50	.200
February	.760	3.42	6.60	.375	.669	14.50	.200
March	.760	3.42	6.60	.375	.669	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
1926	112	88	114	83	90	98	83
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947							
April	138	82	135	75	84	108	83
May	138	82	135	75	84	108	83
June	140	82	135	60	62	53	80
July	142	82	135	64	66	56	82
August	142	85	135	64	66	56	82
September	142	95	135	64	66	56	82
October	142	95	135	68	70	60	83
November	142	95	135	68	70	60	83
December	142	95	135	68	70	60	83
1948							
January	142	95	135	68	70	60	83
February	142	95	135	68	70	60	83
March	142	95	135	68	70	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	151	94	57	160	117	77
1944.....	195	176	152	96	57	174	120	76
1945.....	202	180	154	97	57	175	121	76
1946.....	233	203	177	107	62	240	125	75
1947								
April.....	276	243	215	129	71	354	138	78
May.....	272	242	215	127	71	339	138	78
June.....	271	244	215	125	71	343	140	63
July.....	276	244	219	128	72	359	142	67
August....	276	249	223	130	75	364	142	67
September.	286	253	230	133	79	372	142	67
October...	289	254	230	136	80	387	142	71
November.	287	257	231	135	80	380	142	71
December..	301	262	236	138	81	400	142	71
1948								
January...	307	266	242	139	83	403	142	71
February..	279	263	233	139	85	395	142	71
March.....	283	262	233	131	85	329	142	71

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash are lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Fertilizers for South Georgia Field Crops," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 25, Rev. March 1948.

"Commercial Fertilizers Inspected and Analyzed in the State of Georgia, Year 1947," Dept of Agr., Atlanta, Ga., Serial No. 132, Jan. 1948.

"Report of Analysis of Commercial Fertilizers," La. Dept. of Agr. and Immigration, Baton Rouge, La., Fert. Rpt., Season 1946-47.

"Tonnage of Different Grades of Fertilizer Sold in Michigan in 1947," Soil Science Dept., Mich. State College, East Lansing, Mich.

"Fertilizer Inspection Analysis and Use; 1946," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 511, Oct. 1947, E. A. Trowbridge, L. D. Haigh, E. W. Cowan, and John R. Breuer.

"Tonnage Summary of Mixed Fertilizers, Fertilizer Materials, and Limes Reported as Being Sold in New Jersey During 1947," Agr. Exp. Sta., New Brunswick, N. J., Apr. 9, 1948.

"Eighteenth Annual Report of the New Mexico Feed and Fertilizer Control Office, Year Ending December 31, 1947," State College, N. Mex., R. W. Ludwick and Lewis T. Elliott.

"Analyses of Commercial Fertilizers for Fiscal Year 1946-1947," State Dept. of Agr., Raleigh, N. C., Number 113, 2nd Quarter, 1948.

"Fertilizer Sales 1947," Agr. Ext. Serv., Ohio State Univ., March 22, 1948, Earl Jones.

"Summary of Fertilizer and Fertilizer Materials Sold in South Carolina as Reported by Manufacturers for the Period July 1st through December 31, 1947," Dept. of Fert. Insp. and Analysis, Clemson Agr. College, Clemson, S. C., March 12, 1948.

"Some Basic Information About Radioactive Tracers for Plant Scientists," Agr. Exp. Sta., Texas A & M College, College Station, Texas, Misc. Publ. No. 13, March 5, 1948, Victor A. Greulach.

"Nitrate Accumulation in Cultivated Plants and Weeds," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. 277, Dec. 1946, C. S. Gilbert, H. F. Eppson, W. B. Bradley, and O. A. Beath.

"Ammonium Nitrate for Crop Production," U. S. D. A., Washington, D. C., Cir. No. 771, Feb. 1948, Colin W. Whittaker, Bailey E. Brown, and J. Richard Adams.

Soils

"The Irrigation of SxP Cotton on Clay Loam Soils in the Salt River Valley," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 210, Oct. 1947, Karl Harris, R. S. Hawkins, H. P. Cords, and D. C. Aepli.

"Soils of Idaho," Agr. Exp. Sta., Univ. of Idaho, Mimeo-Leaflet No. 107, June 1947, H. E. Dregne.

"Soil Treatment Recommendations Based on Soil Tests," Ext. Serv., Univ. of Ill., Urbana, Ill., Unno. Cir., Oct. 1947, C. M. Linsley.

"Soil Management Practices, Quitman County," Agr. Exp. Sta., Miss State College, State College, Miss., Bul. 447, July 1947, C. G. Morgan and H. B. Vanderford.

"Soils of Lewis and Clark County," Agr. Exp. Sta., Mont. State College, Bozeman, Mont., Bul. 445, July 1947, L. F. Gieseker.

"Soil Factors Influencing Grape Production on Well-drained Lake Terrace Areas," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 495, March 1948, R. B. Alderfer and H. K. Fleming.

"Soil Testing for South Dakota," Agr. Exp. Sta., S. D. State College, Brookings, S. D., Agron. Pamph. No. 13, Aug. 1947.

Stabilization of Sand Dunes in the Pacific Northwest," Agr. Exp. Stations, State College of Wash., Pullman, Wash., Bul. 492, Aug. 1947, Orlie W. Smith, H. D. Jacquot, and Robert L. Brown.

"Soil Conservation and Farm Income in the Palouse Wheat-Pea Area," Agr. Exp. Stations, State College of Wash., Pullman, Wash., Pop. Bul. 186, Nov. 1947, Maurice C. Taylor and Vernon W. Baker.

"Soil Survey, Brown County, Texas," U. S. D. A., Washington, D. C., Series 1939, No. 4, March 1948, E. H. Templin, I. C. Mowery, W. I. Watkins, T. W. Glassey, and M. W. Beck.

"Selenium Occurrence in Certain Soils in the United States, with a Discussion of Related Topics: Seventh Report," U. S. D. A., Washington, D. C., Tech, Bul. No. 950, Feb.

1948, Hubert W. Lakin and Horace G. Byers.

Crops

"Growing Lespedeza Sericea on Sand Mountain," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., P. R. Series 28, Sept. 1946.

"Milk Production from a Year Around Feed and Forage Cropping System in the Piedmont and Upper Coastal Plain Areas," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., P. R. Series 37, Nov. 1947, J. C. Grimes, D. G. Sturkie, and A. H. Quinn.

"Food for Peace," Ext. Serv., Univ. of Ark., Little Rock, Ark., Cir. 445, Annual Report, 1946.

"Report of the Minister of Agriculture for the Dominion of Canada for the Year Ended March 31, 1947," Ottawa, Ont., Canada.

"Cotton Variety Tests in Georgia, 1945-47," Ga. Exp. Sta., Experiment, Ga., Cir. 155, Feb. 1948, W. W. Ballard, B. S. Hawkins, and S. V. Stacy.

"Release of Dixie 18 Hybrid Corn," Coastal Plain Exp. Sta., Tifton, Ga., Mimeo. Paper No. 52, Feb. 20, 1948.

"Papaya Culture," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, T. H., Ext. Cir. 234, Jan. 1948, William Bembower.

"Banana Culture," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, T. H., Ext. Cir. 238, Feb. 1948, William Bembower.

"Lima Beans, a Possible Commercial Crop for Hawaii," Agr. Ext. Serv., Univ. of Hawaii, Hononlulu 10, T. H., Ext. Cir. 240, Feb. 1948, R. E. Burton.

"Potato Production on Northern Indiana Muck Soils," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Bul. 505 (Rev.), March 1948, N. K. Ellis.

"Performance of Corn Hybrids in Indiana, 1937-1946," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Bul. 526, Feb. 1948, S. R. Miles.

"Grass Silage," Agr. Exp. Sta., Purdue Univ., Lafayette, Ind., Sta. Cir. 333, March 1948, W. A. King.

"Indiana Farms Work for Peace," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Thirty-fourth Report of Purdue University, Report of the Director for the period July 1, 1945 to December 31, 1946.

"Trees, Their Planting and Care," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. 252 (Rev.), 1947, R. B. Hull.

"Wheat Improvement in Southwestern Indiana and Southeastern Illinois," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Second Annual Report, 1947, H. R. Lathrope.

"Modernizing Pastures," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Bul. P86, Jan. 1948, Maurice L. Peterson and H. D. Hughes.

"Annual Report for the Fiscal Year Ending June 30, 1947," Agr. Exp. Sta., Univ. of Mass., Amherst, Mass., Bul. 441, Sept. 1947.

"Maturity Ratings of Corn Hybrids Registered for Sale in Minnesota in 1946," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn., Bul. 395, June 1947, R. F. Crim, H. K. Hayes, E. H. Rinke, Gertud Joachim, R. E. Hodgson, R. O. Bridgford, and O. C. Soine.

"59 Years of Progress in Mississippi through Agricultural Research," Agr. Exp. Sta., State College, Miss., Dec. 31, 1947.

"The Missouri Queen Watermelon, A Wilt Resistant Variety for Southeastern Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 502, March 1947, Aubrey D. Hibbard.

"Winter Barley in Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Bul. 508, Sept. 1947, J. M. Poehlman and C. A. Helm.

"Missouri Peach Culture," Agr. Exp. Sta., Univ. of Mo., Bul. 509, Oct. 1947, T. J. Talbert.

"Good Varieties of Cotton for Missouri," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 318, Nov. 1947, J. R. Paulling.

"Top and Double Working, and Bridge Grafting of Fruit Tress," Agr. Exp. Sta., Univ. of Mo., Columbia, Mo., Cir. 320, Jan. 1948, T. J. Talbert.

"New Jersey Ten-ton Tomato Club Reporting for 1947," Agr. Exp. Sta., New Brunswick, N. J.

"Care and Culture of Farm Woodlots," N. Y. S. College of Agr., Cornell Univ., Ithaca, N. Y., Ext. Bul. 716, Nov. 1947, J. A. Cope.

"Research and Farming, 1946, Sixty-ninth Annual Report," Agr. Exp. Sta., Univ. of N. C., Raleigh, N. C., P. R. No. 4.

"Muscadine Grape Culture," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 306, Jan. 1948, H. R. Niswonger and C. F. Williams.

"Dahlias for the Garden," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. No. 230 (Rev.), Dec. 1947, Robert Schmidt.

"Alfalfa Production," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 307, Jan. 1948, S. H. Dobson and R. L. Lovvorn.

"Inoculation of Legumes," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 309, Jan. 1948.

"Small Fruit Manual for 4-H Club Members," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Rev. Club Series No. 24, Feb. 1948, H. R. Niswonger.

"Farm Science and Practice—Sixty-fifth Annual Report," Agr. Exp. Sta., Ohio State Univ., Wooster, Ohio, Bul. 673, Dec. 1947.

"The Ohio Corn Performance Tests—1945 and 1946," Agr. Exp. Sta., Ohio State Univ., Wooster, Ohio, Spec. Cir. 77, Feb. 1948, G. H. Stringfield and H. L. Pfaff.

"The Yield and Feeding Value of Prairie Hay as Related to Time of Cutting," Agr. Exp. Sta., Okla. A & M College, Stillwater, Okla., Bul. No. B-320, March 1948, H. M. Briggs, W. D. Gallup, and A. E. Darlow.

"More Grain by Efficient Use—Cutting

Losses—Better Production," Fed. Coop. Ext. Serv., Oregon State College, Corvallis, Oregon, Ext. Cir. 498, Dec. 1947, H. A. Lindgren, N. L. Bennion, E. R. Jackman, H. P. Ewalt, H. A. Schoth, and R. W. Every.

"Greenhouse Management," Fed. Coop. Ext. Serv., Oregon State College, Corvallis, Oregon, Ext. Cir. 499 (Rev. of Ext. Cir. 418), Jan. 1948, A. G. B. Bouquet.

"Pennsylvania Corn Hybrid Performance 1943-46 Tests," Agr. Exp. Sta., Pa. State College, State College, Pa., Bul. 494, Feb. 1948, L. L. Huber, B. L. Seem, B. F. Coon, and C. C. Wernham.

"Growing Tomatoes in the Home Garden," Agr. Ext. Serv., Pa. State College, State College, Pa., Leaflet 124, Feb. 1948, J. O. Dutt and R. S. Kirby.

"Treat Seed Grain to Get Bigger Yields and Better Quality," Agr. Ext. Serv., Pa. State College, State College, Pa., Leaflet 125, March 1948, R. S. Kirby.

"Fifty-ninth Annual Report of the South Carolina Experiment Station of Clemson Agricultural College for the year Ended June 30, 1946," Clemson, S. C., Sept. 1947.

"Pecan Production and Marketing in South Carolina," Ext. Serv., Clemson Agr. College, Clemson, S. C., Cir. 301, Aug. 1947, A. M. Musser, T. A. Cole, and W. C. Nettles.

"Fifty-ninth Annual Report, 1946," Agr. Exp. Sta., Texas A & M College, College Station, Texas.

"Oat Production in Texas," Agr. Exp. Sta., Texas A & M College, College Station, Texas, Bul. 691, Sept. 1947, I. M. Atkins and E. S. McFadden.

Economics

"Social Aspects of Farm Ownership and Tenancy in the Arkansas Ozarks," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 471, Sept. 1947, J. L. Charlton.

"The Organization and Income of Owner and Tenant Farms in Boone County," Agr. Exp. Sta., Univ. of Ark., Fayetteville, Ark., Bul. 472, Dec. 1947, Melvin W. Slusher and Otis T. Osgood.

"Costs of Almond Production in California," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 375, Jan. 1948, R. L. Adams and A. D. Reed.

"Farmers and 1947 Income Taxes," Ext. Serv., Univ. of Conn., Storrs, Conn., Bul. 400, Nov. 1947.

"Cost and Utilization of Tractor Power and Equipment on Farms in the Lower Piedmont," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga., Bul. 256, Jan. 1948, J. C. Elrod and W. T. Fullilove.

"1947 Honolulu Unloads, Shipments, and Wholesale Prices of Specified Agricultural Products," Agr. Ext. Serv., Univ. of Hawaii, Honolulu 10, T. H., Ext. Cir. #237, Feb. 1948, Ralph Elliott and Shiro Takei.

"Save Grain for More Food," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Unno. Cir., Feb. 1948.

"What's Ahead for Illinois Farmers in 1948," Ext. Serv., Univ. of Ill., Urbana, Ill., Cir. 621, Jan. 1948.

"How to Save on Feeding Costs," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Leaflet No. 286, 1947.

"Changes in Iowa Population," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Research Bul. 356, Nov. 1947, Ray E. Wakeley.

"Marketing Louisiana Sweet Potatoes in Pittsburgh," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., La. Bul. No. 422, Sept. 1947, J. M. Baker.

"Effect of an Erosion Control Program on Labor & Power Requirements," Agr. Ext. Serv., Univ. of Minn., St. Paul, Minn., Bul. 396, June 1947, S. A. Engene and A. W. Anderson.

"Missouri Farm Census by Counties 1946," State Dept. of Agr., Jefferson City, Mo.

"Range Management and Sheep Production in the Bridger Mountains, Montana," Agr. Exp. Sta., Bozeman, Mont. Bul. 444, May 1947, Harold F. Heady, Richard T. Clark, and Thomas Lommasson.

"Results of a Survey of the Peach Tree Population in New Jersey During 1946," State Dept. of Agr., Trenton, N. J., Cir. No. 369, July 1947, D. T. Pitt and W. H. Brammer.

"Farm Incomes in the Pecos Valley, New Mexico, for 1947," Agr. Exp. Sta., N. M. A & M College, State College, N. M., Press Bul. 1018, Dec. 1947, H. B. Pingrey.

"The Farmer and His Help," Fed. Coop. Ext., Oregon State College, Corvallis, Oregon, Ext. Bul. 683, Oct. 1947, Russel M. Adams.

"The Potato Industry," Oregon State College, Corvallis, Oregon, July 1947, E. R. Jackman, D. B. DeLoach, and C. E. Otis.

Sweet Clover Helps J. Ed McCue

(*From page* 21)

In Mr. McCue's records, kept accurately since he started farming, you will find that about 100 to 200 pounds of 3-12-12 or 2-12-6 have been applied to the wheat each year. The soil is only slightly acid and has a medium supply

of phosphate and about 200 pounds of potash per acre. The soil is a mixed clay loam and probably was once a part of the Wabash river bed. These 6,000 acres are naturally adapted to wheat and corn. Many men have farmed their land, using corn or wheat for six or seven years and then seeding it down to red clover when the yields begin to decline.

"I decided that the deep taproots of sweet clover would puncture the subsoil and help build up the soil, and the proof of the pudding is in the eating," reports Mr. McCue. "Twenty years ago, my wife and I counted the fields of sweet clover adjoining the highway on a trip to the College of Agriculture at Urbana, 200 miles north. We counted six fields on the way up and 12 which we could identify on the right on the return trip. A ratio of one acre of sweet clover to each two acres of corn and wheat seemed a better balance to me and so I started with this unusual rotation.

"I don't want to urge anyone else to follow it, but my tenants like it and none of them went broke during the long depression of the 30's. This rotation has licked the garlic problem on our farms and it has enabled us to farm with less machinery and upkeep costs than any other system."

The soil is protected from erosion 12 months of the year. Yields on the McCue land are about double that of the average for the county and for the area, which is 16 bushels of wheat and 40 bushels of corn. Mr. McCue hopes to increase his wheat yields by changing to Vigo which is resistant to leaf rust and loose smut and stands well.

Sweet clover, four feet high, covers 2,000 acres on the farm. Sweet clover is a big help toward producing 60,000 bushels of wheat and 160,000 bushels of corn each year, and it is never cut for hay nor is seed harvested. It is all plowed back into the soil, and the system works. Mr. McCue says that the nice thing about the system is that yields have been climbing steadily every year and the physical condition of his soil is getting better and better.

Fertilizer Consumption . . . North Central States

(*From page* 14)

field crops before about the year 1940. The reasons for this attitude were explained by some of the people involved as due to the facts pointed out above, to the effect that in this area fertilizers sometimes cost as much as the increased crop yields were worth, rather than because fertilizers failed to increase yields. With the beginning of the recent war in Europe, economic conditions changed radically in this respect. As a result, it is reported that many of the crop and soil scientists of these states started educational campaigns encouraging the use of fertilizers.

In recent years farmer cooperatives of the North Central States have been publishing many articles on fertilizers in the papers they send their members. The farm papers and even city newspapers of the region have also contained many articles on fertilizers in recent years.

Although educational work has had its effect, fertilizer demonstrations have been still more effective. Fertilizer demonstrations have been carried on successfully in recent years by a number of organizations. One of these is the Extension Service. An outstanding example of this sort of demonstration is that of Chapman in Wisconsin. Others doing effective demonstration work with fertilizers in the Midwest in recent years are the State Agricul-

tural Experiment Stations, the U. S. Department of Agriculture, the Tennessee Valley Authority, the American Potash Institute, and the hybrid corn seed producers.

Changes in crops grown have increased the need for plant food in maintaining crop yields and have been an important factor in the growing demand for fertilizer in this section. The North Central States have increased the acreage of corn and soybeans and have decreased the acreage of alfalfa since 1940. At the same time there has been a rapid change to higher yielding varieties, such as hybrid corn and Clinton oats.

In 1940 the North Central States harvested 49 million acres of corn. In 1945 this crop had increased to 59 million acres, or 20 per cent more. Fifteen years ago the entire nation grew less than one million acres of soybeans, but in the past few years the North Central Region alone grew over 11 million acres annually. The total acreage of the 52 principal harvested crops in the North Central States increased from 173 million in 1939 to 195 million in 1945 in spite of shortages of labor. The combined acreage in the North Atlantic, South Atlantic, and South Central Regions was reduced from 123 to 117 million acres in the same period. In 1937 only 12.9 per cent of the corn planted in the North Central States was hybrid seed. This percentage increased to 51.8 per cent in 1940 and to 90.8 per cent in 1946. The high-yielding varieties of hybrid corn remove more plant food from the soil than open-pollinated corn does. In order to take full advantage of the yield possibilities of hybrid corn, many farmers, who received little benefit from fertilizer when they grew corn from their own seed, must fertilize the crop. Furthermore, when seed is purchased at prices ranging from $7.00 to $12.00 per bushel, instead of being saved from the previous crop, the farmer has more incentive to buy fertilizer in order to get the most out of the crop.

In general, the seed companies growing hybrid corn seed require the farmers producing for them to use specified quantities and kinds of fertilizer. Most of these companies also employ agronomists to advise their customers how to get the best results from the use of their seed. These are new developments and have increased the demand for fertilizer. Two-thirds of all fertilizer used in the West North Central States in recent years was applied to corn.

The farming system, the weather, and the natural soil-building processes result in less soil depletion in the North Central States than in those parts of the country where most of the fertilizer is used. Yet many years of cropping have reduced the plant-food reserves of even the rich prairie soils.

The development of relatively inexpensive quick soil tests and of the ability to recognize plant-food deficiency symptoms in plants are factors in making fertilizer recommendations that prove more profitable to the farmer than those that could be made without these aids. The Agricultural Experiment Stations of all Midwestern States make soil tests for farmers. County agricultural agents and many farmers are learning to recognize hunger signs in crops. These developments have no doubt stimulated fertilizer usage.

Modern methods of fertilizer placement give better responses in crop yields than older methods of fertilization. This has made the use of fertilizer more profitable even at prewar prices. Almost all farms in Ohio and Indiana have fertilizer distributors or attachments for applying fertilizer in tillage or seeding operations, but few farmers west of the Mississippi River have such equipment. Since the beginning of the recent war such machinery has been difficult to obtain. Thus many new users of fertilizer are using make-shift methods of applying it. Inefficient distribution gives relatively poor results, which may prejudice users against it and retard consumption in the newer areas.

Shortages of help and machinery have also encouraged many farmers to use fertilizer as a substitute method of keeping up production.

Rainfall has been favorable to the use of fertilizer in the Midwest during the past 7 years. On the contrary, 6 of the 10 years preceding 1940 were drought years when fertilizer might have been relatively ineffective in increasing yields.

High income taxes are said to increase the purchase of fertilizers. The cost of fertilizer is deductible from farm income, because it is part of the expense of the business. The more money spent on cost of production, even though a part of it pays for improvement of the land for the future, the less income tax needs to be paid, other conditions being the same.

Soil Needs

The future requirements of soils for fertilizers are related to the quantities of plant food being removed annually by harvested crops and the quantities applied in fertilizers. Although these

TABLE VII.—RELATION BETWEEN PLANT FOOD REMOVED IN CROPS AND THAT APPLIED IN FERTILIZERS

State and Region	Plant-food content of crops 1947[1]			Plant-food content of fertilizers applied year ended June 30, 1947[2]				Replacement			
	Nitrogen	Phosphoric oxide	Potash	Nitrogen	Phosphoric oxide		Potash	Nitrogen	Phosphoric oxide		Potash
					Available	Total			Available	Total	
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Ohio	188,786	67,954	98,873	19,560	98,893	104,941	54,469	10.4	145.5	154.4	55.1
Michigan	134,970	42,637	92,814	10,089	52,161	55,582	27,555	7.5	122.3	130.4	29.7
Indiana	203,034	74,866	89,849	14,640	81,269	96,506	53,048	7.2	108.6	128.9	59.0
Illinois	373,263	135,881	158,223	10,529	57,684	201,015	29,134	2.8	42.5	147.9	18.4
Wisconsin	216,923	68,058	151,536	9,107	47,511	52,703	31,185	4.2	69.8	76.9	20.6
East No. Central	1,116,976	389,396	591,295	63,925	337,518	510,747	195,391	5.7	86.7	131.2	33.0
Minnesota	301,252	105,898	159,971	4,352	27,002	29,396	10,328	1.4	25.5	27.8	6.5
Iowa	335,517	119,521	159,580	7,202	32,592	39,328	10,316	2.2	27.3	32.9	6.8
Missouri	166,753	57,266	102,377	5,695	43,425	47,839	11,566	3.4	75.8	83.5	11.3
Kansas	306,829	122,962	152,761	2,393	14,046	15,282	1,134	.8	11.4	12.4	.7
North Dakota	213,285	86,936	96,624	382	2,848	3,176	1,043	.2	3.3	3.7	1.1
South Dakota	176,330	66,420	88,996	156	787	1,066	157	.1	1.2	1.6	.2
Nebraska	240,424	85,805	135,515	2,134	2,264	2,452	40	.9	2.6	2.8	.1
West No. Central	1,740,390	544,808	895,824	22,314	122,964	138,539	35,084	1.3	22.6	25.4	3.9
Rest of Country[3]	2,353,609	881,127	1,573,060	653,983	1,247,336	1,976,312	606,681	27.8	141.6	224.3	38.6

[1] Calendar year. The figures represent the portions of harvested crops that are usually removed from the land. They were calculated from the production of the 100 principal crops and their average chemical composition. The production of crops was obtained from: (1) Crop Production Annual Summary 1947, BAE, USDA; (2) Commercial Truck Crops 1947, BAE, USDA; and Truck Crops for Commercial Processing 1947, BAE, USDA. The nutrient contents were taken from: (1) Van Slyke, Fertilizers and Crop Production; (2) Winton and Winton, The Structure and Composition of Foods; and (3) Morrison, Feeds and Feeding. The weights used in converting production in bushels, sacks, crates, etc., to tons are given on page 4 of 1946 Agricultural Statistics, USDA.

[2] Preliminary estimate. Includes Government programs.

[3] Continental U. S.

factors are only a few of those that affect the picture and it is not feasible to present the whole picture, it is believed, nevertheless, that a consideration of these 2 factors will throw some light on the probable future requirements for commercial fertilizers in the Midwest.

The estimated tonnages of plant food removed from soils by crops and applied in commercial fertilizers are compared in Table VII for each North Central State. They are presented without any attempt to interpret them in detail.

It is clear from the figures in Table VII that the eastern part of the region is doing a much better job than the western in maintaining the fertility of the soil. It seems that plant food cannot continue to be taken from the soils of the West North Central States at the present rate without eventually depleting them to the point where large quantities of commercial fertilizers will be needed annually.

Future Consumption

Every person consulted was asked for his opinion on the probable rate of consumption of fertilizer in his state during the next few years. In general, the opinions of the scientists differ from those of the business men, although considerable differences exist in the views within both groups.

The agronomists and soil scientists are influenced in their thinking by the need for maintaining productivity of the soil. They feel that farmers should use more fertilizer than they do even now, that farmers are learning this fact and will therefore continue to use it. Many of them believe that this will depend upon the prices received for crops. Some of them are afraid that crop prices will not stay much longer in the range they have been in during the past few years, while others think that food will be scarce and prices high for some years to come. The consensus of the soil scientists and agronomists consulted is that consumption in this region will reach a peak in 1948 and be somewhat lower for a few years after that. A few expect usage to continue increasing for several years yet. If by any chance, however, farm prices should fall to the prewar levels in relation to prices in general, they agree that fertilizer usage in the West North Central States will drop more percentage-wise than in any other region. When fluctuations in fertilizer usage due to farm income are removed, they believe that a decided upward trend in usage will continue for many years to come. In other words, some of the recent gains will be held in the future even if crop prices do fall. The majority of the scientists believe that the farther west one goes the less rigidly is fertilizer usage geared to farm income.

Fertilizer executives believe that fertilizer consumption is influenced more by economics and farmer psychology than by soil needs. With only two exceptions the fertilizer industry people expect a drop in consumption within the next two years. Some of the reasons for this belief are that fertilizer prices, which had been held stationary from 1943 until 1946 by O.P.A., have increased quite a bit during the past year, and that farm income was at a higher level in 1947 than it is thought likely to be in the next few years. Some of them mentioned percentages varying from 20 to 50 per cent below present levels. Twenty-five or 30 per cent is about the average of 8 or 10 such estimates. Several people, including a county agent and one of the dealers, say that many farmers who now are buying fertilizer do not understand its use and do not know in terms of yields, or dollars and cents, whether it pays them to use it or not. Most of the industry people feel that the majority of farmers in the states west of the Mississippi are not thoroughly convinced of the value of commercial fertilizers even yet. Several said that one severe drought year in the area west of the Mississippi River

would set back the usage of fertilizer in that area for years.

The industry people as a class agree with the agronomists that a part of the gains in usage in recent years will be permanent. They expect a bigger drop than the scientists and expect it to come sooner. All agree that a small drop in farm income would not result in a drop of fertilizer consumption in Minnesota, Iowa, Missouri, and Kansas. This would merely allow supply to catch up with demand in those states. A severe drought or a drop in the price of corn to prewar levels would seriously disrupt the use of fertilizer in the western part of the Corn Belt.

New Production Capacity

A considerable number of new fertilizer plants have been built since the end of the recent war, are now being erected, or are definitely planned for construction within the next year or so. It is important to learn whether or not the total production capacity will be adequate to meet future needs. In view of the way the fertilizer industry overexpanded its production facilities at the end of World War I, it seems worthwhile to consider also the possibility of overexpansion.

Sixty-three new mixing plants, combination superphosphate and mixing plants, or enlargements of such existing plants have been completed in the North Central Region since the end of World War II. The additional production capacities these will provide for the manufacture of superphosphate and mixed fertilizers are listed by states in Table VIII. These figures do not include simple materials such as ammonium nitrate, ground phosphate rock, or potash salts which are bought from other manufacturers and resold direct to farmers. About 22 additional plants are being built or are planned for erection during the remainder of 1948. Table VIII also includes the additions, which probably are not complete. In a few cases tonnages included in the above tabulation may fail to materialize. In most cases the capacity is the official figure of the company involved, but in others it is only an estimate. It is likely that the state capacities are correct to within about 25 per cent of their values. The above discussion does not include new sulfuric acid plants, of which 5 have been recently constructed

TABLE VIII.—ADDITIONS[1] TO FERTILIZER PRODUCTION CAPACITY IN THE NORTH CENTRAL STATES

State	Completed between July 1, 1945 and Dec. 31, 1947		Planned for completion before Jan. 1, 1949	
	Superphosphate	Mixed fertilizer	Superphosphate	Mixed fertilizer
	Tons	*Tons*	*Tons*	*Tons*
Ohio, Indiana & Michigan	173,000	142,000	55,000	42,000
Illinois	290,000	52,000	115,000	140,000
Wisconsin	75,000	173,000	75,000	45,000
Minnesota & North Dakota	.....	91,000	.....	67,500
Iowa	80,000	250,000	105,000	45,000
Missouri, Nebraska & Kansas	100,000	69,500	70,000	18,000
North Central Region	708,000	777,500	420,000	357,500

[1] Includes both new plants and enlargements of old ones. The total new capacity would not be the sum of the new superphosphate and mixed fertilizer capacities, because part of the superphosphate would be used in making the latter. The total new production capacity making adjustments for such duplication would be about 1,170,000 tons already installed and 540,000 tons being built or planned for early erection.

or made available in this region from surplus war plants and 5 more are planned. The 5 plants already available can produce at least 180,000 tons annually and the known planned capacity is 290,000 tons.

The prospects for a substantially increased supply of 45 to 48 per cent superphosphate within a year are good. Two large plants are being constructed in Florida to make 48 per cent goods and an existing plant is being enlarged. One of the new plants is expected to be in operation in 1948 and the other early in 1949. These additions when completed will increase the U. S. production capacity from 490,000 tons to 650,000 tons annually. Definite plans are being made for the early erection of still another plant in Florida. Last fall a group of 8 Midwestern farmer cooperatives organized a company, which bought a large phosphate deposit in southeastern Idaho. Although this organization plans only to ship ground phosphate rock at present, they expect to erect a double superphosphate plant in the future. A more detailed discussion of recent developments in the manufacture of superphosphates was published by Jacob.[5]

Two of the war-built synthetic nitrogen plants are also located in this region. Their capacity to fix atmospheric nitrogen is estimated to be about 270,000 tons annually, equivalent to 800,000 tons of ammonium nitrate.

The capacity to manufacture mixed fertilizers and superphosphate in 1945 before any of the additions listed above were in production is estimated as follows:

State	*Tons*
Ohio	1,000,000
Michigan	150,000
Indiana	450,000
Illinois	600,000
All other North Central	150,000
Total	2,350,000

[5] Phosphate Fertilizer Progress. K. D. Jacob. Fertilizer Review 23 (1): 3-9, 19, 20 (1948).

The consumption of bagged superphosphate and mixed fertilizers in the East and West North Central States in the year ended June 30, 1946, was 2,116,816 and 579,551 tons, respectively, or a total for the region of 2,696,367 tons. Perhaps as much as 200,000 tons of new manufacturing capacity became available in this region during the same fiscal year. But if all the available facilities had been operated at full capacity they would have fallen about 250,000 tons short of producing the amount actually consumed. It is certain, however, that many of these plants did not operate at full capacity during 1945 and 1946, because of shortages of labor and materials. Therefore, at least a half-million tons of mixed fertilizers and ordinary superphosphate were shipped into the North Central Region from other parts of the country. It is known that large shipments were so made from Baltimore, Norfolk, Charleston, and other points.

A total of 455,219 tons of simple materials (ground phosphate rock, ammonium sulfate, muriate of potash, etc.) was sold to farmers in the North Central Region in the year ended June 30, 1946.

It is of interest that the new capacity in several of the West North Central States alone will exceed the highest consumption ever recorded in the same states. Especially impressive is the fact that new plants with a production capacity of over 400,000 tons have sprung up or are contemplated in Iowa, where only 15,000 tons were consumed in 1940 and 200,000 in 1947. If the rate of usage continues to grow as it has for the last few years, the new and old plants will all be needed by 1950. If it does not increase above the present level during the next few years it appears that the less efficient plants may have a hard time surviving.

Great differences exist in the apparent efficiency of the various new plants recently erected. Four men are said to operate one of the new plants with a capacity of 40,000 tons an-

nually and to manufacture 43 tons of mixed goods per hour at a cost of only 15 cents per ton. In most plants of this size the cost of manufacturing mixed goods runs from 50 to 90 cents per ton. Several small plants operating in this area appear to be inefficient. Their mixing costs are unknown but must run well over a dollar a ton.

Appendix

The basic data for this study are given in Table IX. They were obtained chiefly from an analysis of returned questionnaires sent by this office to all fertilizer manufacturers. Unpublished data in connection with the Agricultural Conservation Program and the Tennessee Valley Authority Demonstrations were very kindly supplied by officials of the organizations administering those programs.

The total P_2O_5 of rock phosphate used in these states as a direct fertilizer was found to average about 32 per cent and the available 3 per cent. The insoluble P_2O_5 contents of mixed fertilizers and of superphosphate were assumed to be 5 and 4 per cent of the available, respectively.

TABLE IX.—CONSUMPTION IN GOVERNMENT PROGRAMS, AND TOTAL CONSUMPTION IN THE NORTH CENTRAL STATES OF NITROGEN, AVAILABLE PHOSPHORIC ACID, TOTAL PHOSPHORIC ACID AND POTASH, 1936, 1940, 1944, 1945, AND 1946.

State	Calendar Year	Nitrogen		Available P_2O_5		Total P_2O_5[1]		Potash	
		Government	Total	Government	Total	Government	Total	Government	Total
Illinois	1936	0	958	0	3,948	0	11,358	0	2,242
	1940	0	1,834	1,205	6,912	1,235	21,055	66	4,323
	1944	10	3,691	12,939	30,621	62,706	95,332	0	12,444
	1945	10	4,725	16,676	38,640	94,125	150,707	2,248	21,908
	1946	0	8,051	21,738	47,263	121,798	193,346	2,881	29,371
Indiana	1936	0	5,336	0	34,584	0	36,601	0	19,922
	1940	0	5,354	372	38,934	381	42,020	8	24,990
	1944	39	8,425	16,623	58,331	19,150	65,018	0	40,498
	1945	13	10,434	18,282	63,252	21,717	72,330	9,441	48,035
	1946	13	13,192	21,593	78,709	26,743	90,074	10,445	52,527
Iowa	1936	0	106	0	925	0	978	0	499
	1940	0	263	443	2,720	454	3,200	2	882
	1944	1	1,160	8,633	15,661	10,091	18,182	0	4,651
	1945	0	1,610	13,274	27,855	15,426	31,205	1,338	8,246
	1946	0	5,422	18,517	32,913	21,189	37,538	1,153	10,463
Kansas	1936	0	164	0	2,060	0	2,112	0	135
	1940	0	160	267	4,223	274	4,642	0	205
	1944	1	176	5,982	10,362	6,280	10,953	0	390
	1945	0	341	3,535	9,718	3,712	10,274	0	575
	1946	0	1,295	1,663	11,345	1,844	12,189	0	1,022
Michigan	1936	0	3,042	0	16,051	0	16,854	0	8,195
	1940	0	4,197	270	21,770	277	22,859	161	12,642
	1944	7	8,299	20,955	42,117	22,045	44,383	0	21,991
	1945	4	8,536	23,706	44,841	24,924	47,266	9,140	26,647
	1946	5	9,866	26,813	53,383	28,035	56,419	9,237	27,249
Minnesota	1936	0	231	0	1,352	0	1,420	0	1,149
	1940	0	449	382	3,770	392	3,958	11	1,494
	1944	0	1,256	7,668	16,797	8,162	17,848	0	4,452
	1945	0	1,669	8,574	22,036	9,165	23,591	372	6,626
	1946	0	3,065	12,757	29,091	13,389	31,084	860	8,799
Missouri	1936	0	1,619	0	14,834	0	15,578	0	2,078
	1940	0	1,062	1,281	13,193	1,313	13,931	1	2,029
	1944	23	1,867	17,719	34,268	18,751	36,388	0	5,209
	1945	18	2,540	15,456	27,932	16,455	29,944	1,340	6,870
	1946	3	5,097	21,439	38,830	23,167	42,187	2,309	10,285
Nebraska	1936	0	0	0	304	0	319	0	0
	1940	0	20	1	873	1	917	0	17
	1944	0	24	0	866	0	909	0	2
	1945	0	385	0	774	0	813	0	4
	1946	0	1,557	0	2,183	0	2,292	0	40

TABLE IX (*Continued*)

State	Calendar Year	Nitrogen		Available P_2O_5		Total P_2O_5[1]		Potash	
		Government	Total	Government	Tota	Government	Total	Government	Tota
North Dakota	1936	0	2	0	114	0	120	0	2
	1940	0	14	2	624	2	655	0	19
	1944	0	54	40	1,232	42	1,294	0	252
	1945	0	132	114	1,362	120	1,430	0	566
	1946	0	270	216	2,017	227	2,118	0	861
Ohio	1936	0	6,844	0	47,032	0	49,390	0	15,408
	1940	0	8,901	1,234	48,448	1,265	50,893	10	22,744
	1944	74	14,990	28,889	81,351	31,125	85,690	0	41,304
	1945	14	17,760	29,878	80,894	31,396	85,164	14,152	46,239
	1946	0	18,417	28,542	94,437	29,993	99,732	12,269	51,658
South Dakota	1936	0	0	0	45	0	47	0	0
	1940	0	3	0	209	0	219	5	3
	1944	0	2	6	73	69	119	0	10
	1945	0	6	34	128	41	151	3	19
	1946	0	124	109	685	114	754	10	139
Wisconsin	1936	0	946	0	4,103	0	4,368	0	2,758
	1940	0	1,548	1,748	11,492	1,792	12,236	274	5,699
	1944	39	5,950	15,947	34,764	17,267	37,223	0	17,135
	1945	38	8,629	15,521	33,575	16,839	36,075	7,198	24,470
	1946	19	8,250	23,759	43,165	24,933	46,079	11,411	27,955
North Central	1936	0	19,248	0	125,352	0	139,145	0	52,388
	1940	0	23,805	7,205	153,168	7,386	176,585	538	75,047
	1944	194	45,894	135,401	326,443	195,688	413,339	0	148,338
	1945	97	56,767	145,050	351,007	233,920	488,950	45,232	190,205
	1946	40	74,606	177,146	434,021	291,432	613,812	50,575	220,369
Total U. S.	1936	0	350,390	51,631	672,849	52,147	719,586	21,375	350,075
	1940	0	419,093	165,404	912,255	168,712	988,642	4,709	435,016
	1944	4,106	634,550	392,566	1,405,222	465,228	1,549,814	38	648,981
	1945	2,258	642,404	479,074	1,435,035	583,956	1,629,079	59,945	753,154
	1946	180	730,000[2]	532,344	1,535,000[2]	664,920	1,764,645[2]	73,538	819,000[2]

[1] Includes the total P_2O_5 of phosphate rock, bone meal, natural organics, and the insoluble P_2O_5 of superphosphate.

[2] Preliminary.

Will These New Tools Help . . . Soil Problems?

(*From page* 24)

that do not last too long in the soil possibly also can be used to kill the cover crop.

Following the application of herbicide, the soil would be tilled with one of the new plows that do not turn a furrow. For these particular studies, I am thinking of a type of plow which consists of number of tines on a rigid frame. The depth of these tines can be regulated so that compact areas are broken up. If not fertilized beforehand, arrangements could be made to run the fertilizer in behind the tines. Likewise, seed could be dropped behind the tines provided contact with the fertilizer was avoided. If the cover crop mulch was insufficient to prevent weed growth in row crops, it should be possible to work out subsequent herbicidal treatments using guards to avoid injury of sensitive crop plants.

Many practical difficulties need solving before this system can be put into practice. Considerable information needs to be gathered as to: (1) Cover crop best suited to the system; (2) if not winterkilled, the most appropriate time when the cover crop should be killed and with what materials and in what concentrations; (3) best manner of adding fertilizer in such a system;

(4) suitable methods of seeding particularly small seeds at shallow depths; and (5) methods of killing any subsequent weeds.

These difficulties do not seem to be insurmountable. On several phases we already have some indication as to approaches in solving the problem. Aid from agricultural engineers as well as from agronomists, horticulturists, and soils experts is needed. Together these experts should be able to work out a system that is practical and greatly improved over our present methods of farming

What Would Be Accomplished

If successful, let us see what this system can accomplish. No longer would the soil be exposed for long periods of the year to the destructive action of wind or water. Plowing across the slope should create many small furrows which would trap water. Due to this containment of water and elimination of the destructive force of raindrops, erosion would be markedly reduced. With better water retention plus lowering of evaporation due to the mulch and condensation of moisture due to lower soil temperature, soils should contain appreciably more moisture for crops. There should be very little soil compaction at the surface and therefore better aeration. All cultivation would be eliminated for it would not be necessary for weed control or for breaking of crusts at the surface.

The system has certain inherent economies. Theoretically, it should be possible to prepare the soil and seed in one operation, eliminating various harrowing and disking operations. Likewise, avoidance of cultivation should add economies in the long run.

The advantages of such a system are so great that considerable time and effort should be spent in evolving a practical one. Once this is done it would seem possible to obtain greater yields of high quality crops without destroying the soil and at costs which would compare favorably with our present destructive system.

Better Markets for Better Crops

(*From page* 26)

considerations like refrigeration and ripening rooms. Methods and costs are analyzed and the staff keeps an eye on inventions and new developments.

Our huge production on farms and our growing population in the cities have intensified many of our marketing problems and have taxed our market facilities to the utmost. Expansion has come more swiftly and decisively at each end than in the middle. Something must be done to ease the strain. New and rehabilitated city markets will help to do the job.

More Abundant Living with Soil Conservation

(*From page* 20)

the production of wheat and milo an average of 3.1 bushels per acre per year or 36 per cent during a 10-year period at Goodwell, Oklahoma. Improved pastures, properly fertilized, yield up to two or three times as much green feed of better quality than those not fertilized. Abandoned and formerly unused, shallow, rolling, scrubby-oak land was successfully converted

SCS Photo

Fig. 6. Terraces and contour cultivation conserved an average of 42 per cent more water than land cultivated with the slope during a five-year period on the Wheatland Conservation Experiment Station, Cherokee, Oklahoma. This water was stored in the soil. Reports throughout the Southern Great Plains show that terraces and contour cultivation increased the average annual yield of wheat about three bushels per acre.

into pastures for livestock production at Guthrie. The amount of beef obtained compared favorably to that produced on the range land of the area.

Soil Conservation Research is determining the best and most productive capacity of the land. For example, investigations at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma, show that severe erosion can be controlled, runoff water materially reduced, and crop and food production maintained at about two-thirds higher level by combining sound land use, adequate fertilization, and practical conservation farming. Such findings are now being applied on farms and ranches by cooperators of the Soil Conservation Districts. Farmers who have received this assistance have immediately increased production and are now producing millions of tons more food. And in addition they are conserving and improving their land for generations to come.

Louis P. Merrill, Regional Conservator of the U. S. Soil Conservation Service at Fort Worth, Texas, says this research and the work of the Soil Conservation Districts in Oklahoma, Texas, and Kansas are so outstanding and revolutionary that it is practically the equivalent of discovering about seven million acres of new land Furthermore, H. H. Bennett has said, "In addition to furnishing a sound basis of land use and many farming operations, this system of soil conservation improvement and land management paves the way to permanence and stability of the whole agricultural industry." Sound development and use of agricultural land resources will preserve national resources, maintain more abundant living, reduce floods, prevent impairment of reservoirs, maintain the navigability of rivers and harbors, and protect public health.

But there are many areas in which we do not have a satisfactory soil and water conservation program. This is the reason soil, water, timber, and other natural resources are still being destroyed faster than they are being

saved. Here is where we must have more research in order to determine the "know-how" and show farmers and land-owners economical and productive methods of sound land use, improvement, and management suited to their soil and climatic conditions.

Many of our farmer operators have become conservation minded and have done much to improve and save the soil. But all the people must be taught to save and love the land. Soil-saving and soil-using training should be started with the child. Stories, beginning in the books of the grade school, might be evolved around the principles of saving the soil. This type of training, together with more extensive research, demonstrations, and technical training, would bring about greater love for the land and expedite the progress of the soil-saving program. This would give the people a greater appreciation of the need and importance of saving the soil for the building of a world of greater abundance and opportunity.

Weed Time Cometh

(*From page* 5)

gaunt timber wolf, both hardier than the best kept cattle and the petted dog.

If farmers and nature would strike for a couple of seasons, science would have to get busy and make human food out of weeds and wild roots. The fear of weeds on abandoned farms has saved the skins of many farmers with delinquent mortgages. The lender says, "better keep a losing farmer on the land than to leave it idle and get weed-ridden."

There may be some negative virtues about weeds, but they do not endear them to us. At times weeds may help to retain nitrates in the soil on land that runs fallow, and weeds are useful as green manure for plowing under sometimes. But no doubt their chief advantage lies in their persistence which makes good tillage so vital. Their luxuriance drives mankind to invent and to apply tools and implements with which to uproot those undesirables. This often keeps him so busy he forgets to worry about himself.

WE must prepare to live with the weeds for some time to come, willy-nilly. So maybe we can afford to look for any hidden values they have. We try to do that for our human neighbors so as to improve relations in general.

Sweet clover has become a boon companion to the farmer within recent decades. When I was a stub-toed kid, this plant was only a tramp found thriving along roadsides and railway embankments. Farmers prized their timothy and Johnson grass but chortled aloud if anybody suggested possible cultural values in ordinary rank sweet clover. But that was before the county agents raved about the "noodles" on plant roots and before nitrogen fixation and bacteria cultures had gained credence and use.

There are plenty of other cases. Spurrey, a very common weed, is used as a fodder crop in Belgium. You and I have gathered dandelions for greens and potable purposes. Chicory, that blazing blue star-flowered weed, has been used as a coffee substitute. Quack-grass roots are said to be relished as food in Italy. In fact, several main varieties of garden vegetables were probably weeds in their native habitat.

Bees treat the flowering weeds just as impartially as the rain treats them, using no superior man-sized judgment whatever. Bees like fireweed and we like the nectar they suck from it. That old-fashioned garden of Grandma's held many posies that got to be aristo-

crats by a devious route. Cornflowers, poppies, asters, and scarlet pimpernel testify to the truth that even a member of the weed tribe can make its inherent beauty so keenly appreciated that all its naughty habits are soon overlooked and it brings a fancy price in little packets.

COOKING herbs and medicinal plants have had a full part in the humanics of this country. Tansy, pennyroyal, sage, lavender, coriander, marjoram, savory, and balm—all speak legends to us of other days and simpler customs. They haunt us from old dusty rafters and shake their prim powder at us from ancient attic chests. Garden show spots, such as Mt. Vernon, still feature these escaped denizens of the herbal world.

Even though a weed is a plant out of proper place, who is to say after all or to know with absolute truth what its real place is? All we know now is where it should not be when it interferes with cultural programs we have hatched the winter before around the fireside.

Man has chosen to be a consumer of livestock meat, and most livestock usually prefer cultivated cereal and forage crops to the ordinary run of wild growth—with some alarming exceptions. Locoweed and wild garlic are at least two weeds that sadly interrupt man's schemes for animal husbandry of top order. Why did the Creator endow animals with a love for plants that transmit poison or bad flavors to livestock products? This seemingly is another one of the imponderables without satisfactory answer.

Some folks have quarreled with the use of the term "weed eradication" and would make it "weed limitation" to save face perhaps. Weed conquest is no amateur's job. An urbanite who says he has whipped the weeds in his little greensward should not go countryward to instruct the farmer. While he is busy scoffing and deriding, the birds are busy carrying more chickweed and kindred messes back onto his precious lawn. He who laughs last on the weed question is wiser, but he who never laughs is wisest of all.

There have been as many rock-ribbed and automatic plans advanced to settle the weed question as there are vague policies afloat to settle prohibition, coal-mining labor, or racial equality. There exists a time-worn list of rival prejudices and opinions on baby care, more service and less taxes, farm relief, and weed control, not to mention juvenile delinquency—all of it more or less vulnerable.

I would not halt such folks from arguing or stating the case as they see it, but when it comes to putting ideas into actual practice, let them try it on somebody else's acreage. I stick to the data tested and tried through experiment station endeavor, plus the better methods achieved the hard way by patient farmers.

Thus weeds cannot escape a lasting niche in our hall of infamy, if for no other reason than that they give us all something useful to do and something interesting and purposeful to wrangle over. I therefore will not foist upon you my personal experience in subduing encroaching plant enemies, lest you try it and find them gratified and growthy.

BUT this we all agree upon—that weed control is best accomplished through community action, just like any other reform that seems justified. One lorn farmer trying to push back the weed lines in a lousy neighborhood deserves credit for idealism and ambition, albeit his hopes may be vain ones.

Where weeds spell a reduced cash crop income through mixtures or where foreign matter in grain lowers its sales value, it is easier to get a few planks nailed on the anti-weed bandwagon. But where weeds merely get into the hay crop or into some feed grain, the job of arousing action is often difficult.

Of course, many farmers hate weedy

fields just as their good wives dislike dirty floors, so that it does not require a cash deficit to open their eyes to group action. But as a rule such zealots die young from their crusading labors, leaving the land once again to the Huns of herbage.

There is some difference between misplaced plants and a man who is a misfit. These may resemble each other in some ways, but they are unlike in others. A man out of proper place is like a fish out of water, all thumbs and bungling. But a plant out of place seems to grow fully as well and take as big bites of the plant-food supply as a plant in its accustomed habitat. A man seldom grows in stature and stamina when out of place, but a misplaced plant will wax and grow fat in spots not intended for it, as long as the soil is favorable.

THIS brings us to say again that the foundations for good in both man and plants lie with the soil and good environment. When we make a better community in which all humanity lives and thrives abundantly, we boost the best in mankind. We do not hesitate to provide that better environment just because a few misfits or morons also may take advantage of it.

It is likewise so with plants. Your complete formula of drilled fertilizer or manure will benefit the mustard and the dodder while it also invigorates the wheat and the clover we cherish. Yet, he who would withhold any nutrient from the land simply because he is afraid the wrong plants will imbibe and benefit by it is mostly mistaken. There are better ways of doing it than that.

Hence it appears that to ward off tares in crops or bad habits in man is to insist on the right kind of pure seed, well tested for germination, plus a high degree of soil fertility and proper environment. This saves us sweat and swear words. But neither seed, environment, nor fertility will save us from work. So let's get back to it.

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LaMotte Soil Testing Service is the direct result of 27 years of extensive cooperative research with agronomists and expert soil technologists to provide simplified soil testing methods. These methods are based on fundamentally sound chemical reactions adapted to the study of soils, and have proved to be invaluable aids in diagnosing deficiencies in plant food constituents. These methods are flexible and are capable of application to all types of soil with proper interpretation to compensate for any special soil conditions encountered.

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AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
H-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
H-2-44 Efficient Fertilizers for Potato Farms
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
DD-5-45 A Case of Combined Potassium and Boron Deficiencies in Grapes
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
TT-10-45 Kudzu Responds to Potash
ZZ-11-45 First Things First in Soil Fertility
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
S-4-46 Plow-under Fertilizer Ups Corn Yields
T-4-46 Potash Losses on the Dairy Farm
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
BB-5-46 The Soil Is Our Heritage
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NN-10-46 Soil Testing—A Practical Aid to the Grower & Industry
WW-11-46 Soil Requirements for Red Clover
ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
B-1-47 The Use of Dipicrylamine in Tissue Testing for Potash
C-2-47 Research Points the Way for Higher Corn Yields in North Carolina
I-2-47 Fertilizers and Human Health
K-2-47 Potash Pays for Peas at Chehalis, Washington
N-3-47 Efficient Management for Abundant Pastures
P-3-47 Year-round Grazing
Q-4-47 Fertilizers for Sugar Beets
S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
V-4-47 Don't Feed Alfalfa at the "Second Table"
X-5-47 Potato-growing Developments in New England
Y-5-47 Increasing Grain Production in Mississippi
Z-5-47 Building and Maintaining Good Lawns
AA-5-47 The Potassium Content of Farm Crops
BB-5-47 More Palatable Grass Is More Nutritious
DD-6-47 Profitable Soybean Yields in North Carolina
GG-6-47 Corrective Measures for the Salinity Problem in Southwestern Soils
II-8-47 Whole-farm Demonstrations
MM-8-47 Fertilizing Potatoes Economically in Aroostook County, Maine
NN-10-47 Let's Replace Guessing with Soil Testing
PP-10-47 Potash Fertilization of Alfalfa in Connecticut
QQ-10-47 Fertilizer Placement for Corn on Sandy Soils of Minnesota
SS-10-47 Soil Fertility and Management Govern Cotton Profits
TT-11-47 How Different Plant Nutrients Influence Plant Growth
UU-11-47 Fertilizer Practice for the Ranger Sweet Potato
VV-11-47 Are You Pasture Conscious?
WW-11-47 At the Tip of the Shoot and the Point of the Root
XX-11-47 Fall and Winter Grazing in Mississippi
YY-11-47 Boron for Vermont Farms
ZZ-11-47 Some Things to Think About
AAA-12-47 Soil Aeration and Crop Response to Fertilizers—1947
BBB-12-47 The Management of Mint Soils
CCC-12-47 Do Soybeans Cause Clover Failures?
DDD-12-47 Florida Grows Good Pasture on Coastal Plain Soils
A-1-48 Let's Foster Fertility
B-1-48 Potash Supplies for 1948
C-1-48 Fertilizers Double and Treble Grain Yields in Northern Wisconsin
D-1-48 A Good Combination: Lespedeza Sericea and Crimson Clover
E-2-48 Root Rot of Sweet Clover Reduced by Soil Fertility
F-2-48 Swapping Plant Food for Corn
H-2-48 Soil Testing and Soil Conservation
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K-3-48 Peanut Land and What It Needs
L-3-48 Radioisotopes: An Indispensable Aid to Agricultural Research
M-3-48 Hitting the Target: 100 Bu. Corn Per A.
N-3-48 Ground Cover

THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON 6, D. C.

Walter was going to have a party, and his mother insisted on his inviting, among others, a neighbor's boy with whom he had had an argument. He finally promised he would do so, but on the day of the party the neighbor's boy failed to turn up.

Walter's mother became suspicious. "Did you invite Charlie?" she asked.

"Of course I did, mother. I not only invited him to come, I dared him to."

* * *

From the sign on a wall in an Arizona restaurant: "We have an agreement with the First National Bank: They will serve no sandwiches, and we will cash no checks."

* * *

Her (at prom)—"Wait right here for me, Bill, while I go powder my nose."

Her (three dances later)—"Been waiting long?"

Him—"No, but I've been looking all over for you to give you your compact."

* * *

JUST KIDDING

A woman complained to an elderly man, who every evening walked his dog by her house, because the pup always paused by her new shrubs.

"I wouldn't worry," he said, "I always start around the block the long way, and by the time he reaches your bushes, it's only a gesture."

Judge: "On what grounds are you applying for divorce?"

Mr. Brown: "Extravagance, your Honor."

Judge: "Extravagance? How's that?"

Mr. Brown: "She kept on buying ice after I had installed an electric refrigerator."

* * *

JUMPER

A United States Army officer stationed in Australia decided to go on a kangaroo hunt. He climbed into his jeep and instructed his Negro driver to proceed to the plains in quest of a kangaroo. Soon they spotted one, and the driver drove the jeep in hot pursuit.

For some time they went at breakneck speed without gaining on the animal.

Finally, the driver shouted to the officer: "Ain't no use chasin' that thing, sir!"

"Why, Sam?"

"'Cause we is now doin' 65 and that critter ain't put his front feet down yet!"

* * *

"Do you know what good clean fun is?"

"No, what good is it?"

* * *

"Look heah, Rastus, you all know what you're doin'? You goin' away for de week-end and there ain't a stick of wood cut for de house."

"Well, what you all whinin' about, womin? I ain't takin' de axe am I?"

FERTILIZER BORATE

more economical

FOR AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities, or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work and recommendations of the State Agricultural Stations and County Agents are steadily increasing the recognition of the need for Boron in agriculture.

Boron is a plant food element and is commonly obtained from Borax since the element does not occur in the pure form. Fertilizer Borate is a semi-refined product containing 93% Borax.

Fertilizer Borate was placed on the market by the makers of "20 Mule Team Borax" as a fertilizer grade product to save cost of refining and hence to supply Borax at the lowest cost.

Fertilizer Borate is packed in 100 lb. sacks. Address your inquiries to the nearest office.

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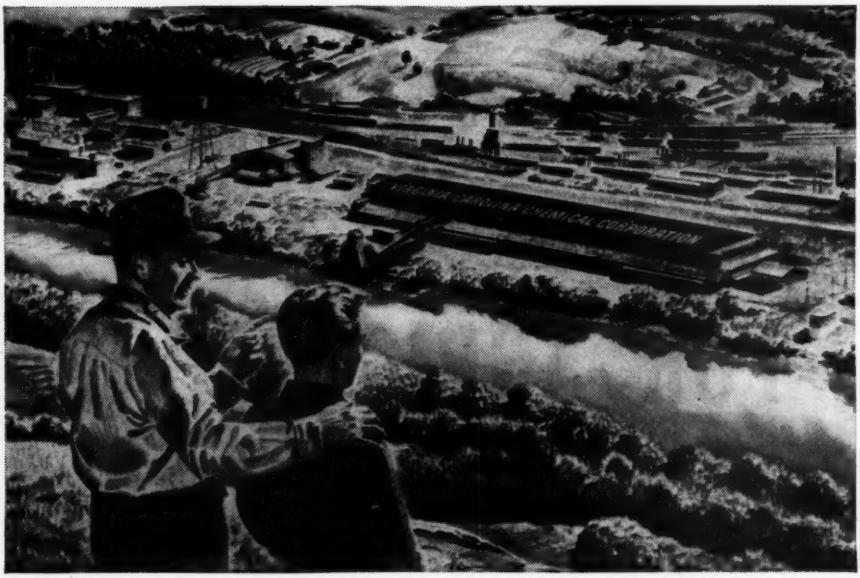

"That Factory is Our Farm's Best Friend"

IN MANY COMMUNITIES in many states, farmers look upon the local V-C factory as an old and trusted friend.

For economy and convenience, each V-C factory is located near the farms it serves. Yet each factory benefits from the scientific research, experience, skill and facilities of a national organization.

Through its network of 36 fertilizer factories, its phosphate rock mines, its 21 sulphuric acid plants, its 28 superphosphate producing units, and its analytical and research laboratories, the V-C organization is helping to make farming a better-paying business in every state from the Rocky Mountains to the Atlantic and from Canada to the Gulf of Mexico.

Virginia-Carolina Chemical Corporation is superbly equipped with men, mines and factories to produce the right plant-food mixture for every crop on every soil. Backed by this great national organization, each individual local V-C factory concentrates on supplying the particular plant-food needs of the farms in the territory it serves.

Farm folks, everywhere, like this efficient V-C method of manufacturing and selling honest and dependable fertilizers which produce the utmost in extra yields of profitable crops. Through the years, Virginia-Carolina Chemical Corporation has continued to win and hold the loyal friendship of more and more V-C customers—reliable agents and dealers and thousands of good farmers who try V-C Fertilizers and then keep on buying and using V-C Fertilizers.

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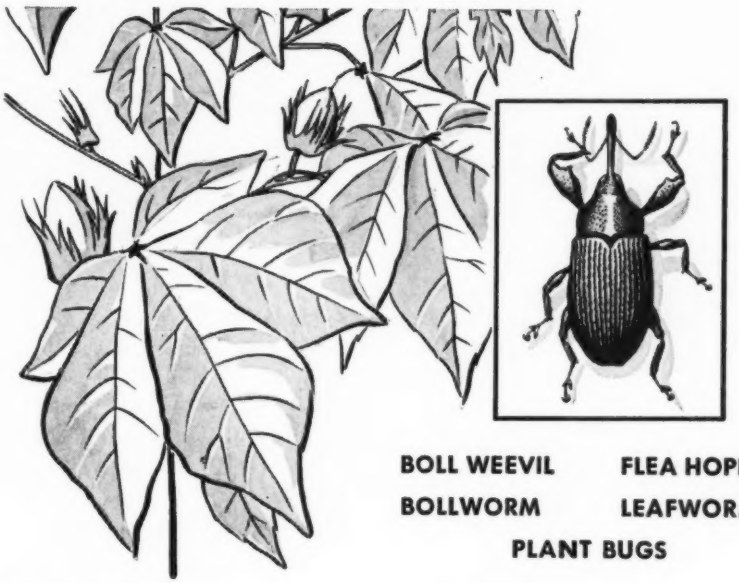

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BOLLWORM **LEAFWORM**
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TOXAPHENE-20
a dust to control cotton Boll Weevil and Bollworm, cotton Flea Hopper, cotton Leafworm, Thrips, Southern Green Stink Bug, Rapid Plant Bug and Tarnished Plant Bug.

Dosage: 10 lbs. per acre

TOXAPHENE-S-20
contains 40% sulphur to control Red Spider in addition to insects listed above.

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THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

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Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)
Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

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